

Working Paper Series

EXPLOITATION OF ONTARIO MINERAL RESOURCES
AN ECONOMIC POLICY ANALYSIS

J. Clark Leith

December, 1976 ✓



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No. 2/76

Ontario Economic Council
Toronto, Ontario



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Acknowledgements:

This study received the financial support of the Ontario Economic Council which is gratefully acknowledged. Thanks are also due to B.T. Duong and W. Whitney for their energetic research assistance; to my colleagues A.G. Blomqvist and T.J. Courchene and the O.E.C. readers for their penetrating comments; and to G.A. Jewett and G. Anders of the Ontario Ministry of Natural Resources for many hours of helpful discussions. The views expressed, however, are entirely my own.



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Introduction

Ontario's mineral wealth has long provided us with a substantial portion of provincial income, provincial employment, and provincial tax revenue. We have prospered in the process. Yet a nagging doubt remains in the minds of both government officials and the public at large: do we obtain the optimum benefit from the use of our mineral resources? There is doubt because a stock of non-replenishable raw mineral wealth is being used up when, instead, it might be kept in the ground for future use. Doubt also exists because raw minerals are extracted and shipped without, in some cases, substantial further processing. Concern also exists over whether or not we should exercise our potential power over the world markets of minerals.

Despite the importance of these and similar policy questions, the level of discussion in recent years seems to have become bogged down in the rudimentary rhetoric of "selling our birthright" or condemning our people to remain forever as "hewers of wood and drawers of water," or "public vs. private ownership."

This study is by no means the first bearing on the sector. In the 1950's John Davis produced a major review of the state of the mineral sector in Canada for the Gordon Royal Commission on Canada's Economic Prospects, entitled Mining and Mineral Processing in Canada. For one of the major economic royal commissions of the 1960's, the Carter Commission on taxation, M. W. Bucovetsky (1966) completed a further masterful examination of the sector, while the Ontario Committee on Taxation (1967) also tackled the issue of mineral taxation. Now in the 1970's the public policy debate has been resumed with ever greater vigor.

The locus of the recent debate includes the provincial as well as the federal scene. Professor Eric Kierans authored a study of the institutional options open to the Manitoba government: Natural Resources Policy in Manitoba. Another study has been made by the Ontario Provincial Legislature's Select Committee on Economic and Cultural Nationalism (Ontario, 1974a). The

provincial and federal ministers responsible for mineral policy have also been at work, agreeing on a document entitled Mineral Policy Objectives for Canada, as well as launching a comprehensive attempt to agree on a set of policies to achieve those objectives. In the meantime the various finance ministers, in their search for new revenue sources, have not failed to note the potential revenues to be extracted from the sector. New taxes have been levied both federally and provincially. In response, the provincial and national mining associations have spawned a public relations effort of substantial proportions.

In the flurry of the competitive debate, the nature and the logic of the public policy issues have often become obscured. In the belief that the economic issues bear significantly on the overall choices to be made, this study is designed to set out the issues involved in public economic policy towards mineral resource exploitation in Ontario.

The issues are far from trivial. The mineral sector generates over \$700 million of Ontario gross provincial product. Further, because of the necessary concentration of much of the mineral extraction activity in specialized locations, the incidence of policy changes are often substantially greater than the aggregates would suggest.

We begin this study with a review of the mineral sector (Part I). This is designed to show, in broad terms, the way the sector has developed, its current significance on the provincial scene, and its major structural characteristics. All of this is so that we can consider the policy framework (Part II) in a realistic setting: not simply an abstract discussion. The policy framework focuses on the key question of whether or not there is a reasonable economic case for policy intervention in the mineral sector. Finally, in Part III we explicitly address the issue of policy choices.

I. Review of Mineral Sector in Ontario

1. Historical Development

(1) The Early Years

The history of mining in Ontario dates back to about the year 1800. At that time a small blast furnace was erected at a place now known as Lyndhurst, midway between Kingston and Smiths Falls. The ore proved to be of poor quality, however, and the project was soon abandoned. Another attempt in 1822, this time on Lake Erie in Norfolk County, was more successful. The annual yield was about 800 tons of pig iron and the operation was profitable until 1847, at which time the ore and fuel were depleted.

During this same period there were numerous attempts to work the deposits at Marmora and Madoc in Hastings County, but none of the ventures were economical. By 1848 the St. Lawrence canal system was providing a source of cheap transportation for imported products and no smelting operations were able to withstand the competition. Some of the last successful iron mining operations of this early period were mines in Leeds County which shipped ore to Pittsburgh via the Rideau Canal system and Lake Ontario. In 1883 a depression in the iron trade and a U.S. tariff on imported ores effectively ended this trade.

Most of the mineral production of Ontario in the nineteenth century consisted of building materials and some petroleum products. Aside from iron, gold, and silver, production of most metals was not significant. With a few exceptions this was a period of discovery and not production.

Copper was discovered near Sault Ste. Marie at Bruce Mines in 1846. Production started in 1847 and after varied success, closed in 1876. The

first sighting of nickel in Ontario was at the so-called Wallace mine on Lake Huron in 1848. There was another discovery on Michipicoten Island but neither of these deposits was exploited.

The first discovery of gold in Ontario was made in 1866 near Madoc. The following spring saw a minor rush of gold seekers and the area was intensively prospected. There were other discoveries, north of Lake Superior in the 1870's, Lake of the Woods area in 1878, and Sudbury in 1887; however, none of these finds was spectacular. Gold mining and metallurgical methods of the day were crude, so only the richest finds proved profitable.

There have been two distinct eras of silver mining in Ontario, the first beginning in 1866. The finds were located around the City of Thunder Bay, and of all the mines in the area the leading producer by far was Silver Islet. It was discovered in 1868, and after frequent floodings and changes in ownership, was closed in 1884. The total production of the Silver Islet mine was valued at \$3,500,000.

Railway construction played an important role in the mining industry of Ontario, first by leading men to the sites of deposits and second by providing the transportation, making exploitation economical. No case illustrates this better than that of Sudbury. The Canadian Pacific Railway had reached there in 1883 and a rock cut on the right of way revealed a deposit of copper sulphide. This deposit developed into the Murray mine yielding both copper and nickel. Production began in 1889 with many mines soon following.

(2) The Turn of the Century

By the turn of the century mineral production in Ontario had reached a little over \$9 million a year. Metallic output accounted for less than one third of that amount, \$1 million of iron ore being the largest component.

Construction of a blast furnace in Hamilton in 1895 provided a new market for good quality ore and 1896 saw a revival of iron ore production in Ontario. Most of the ore came from mines of Hastings, Frontenac and Lanark counties. Iron deposits were known to be numerous and widespread throughout the province, but low grade ore, or lack of good transportation hindered development. The latter was the case for deposits in the Atikokan area. One exception was the Helen mine near Lake Superior. Discovered in 1897 and beginning production in 1900, its ores were exported to the U.S. by steamer.

Silver production, which had become non-existent by 1893, was renewed in the Lake Superior region in 1898. Annual output reached a peak of about \$100,000 in 1900 and then tapered off until the finds in the Cobalt area. Gold production was progressing steadily in both east and west until 1899 when the value of output exceeded \$400,000. Production then fell off and remained in a slump until 1911, for in 1900 the U.S. fixed the price of gold at \$20.67 per ounce. Also in 1899 zinc was discovered on the North Shore of Lake Superior, however production had ceased by 1903.

The last decade of the nineteenth century brought two developments of great importance for the future of Sudbury's copper-nickel deposits. A number of people had been doing research on the use of nickel as an alloy for hardening steel. The results of the research were first made public in 1889. The U.S. Navy Department was quick to appreciate the importance of this discovery and soon had Congress approve a one million dollar purchase of nickel for use in the construction of warships. Up until this moment copper had been the relatively more important metal. The other development came in 1892 when two processes for the separation of nickel and copper were

discovered. Thus the future importance of the Sudbury deposits was assured. By 1900 the value of the combined output of nickel and copper exceeded one million dollars annually.

(3) The Modern Era

The growth in importance of Ontario mineral industry is closely associated with the development of the world's industrial economy. The modern era is marked by the dominance of metallic mineral production. Metallics account for approximately 80% of output, with base metals growing in importance relative to precious metals.

Construction of the Temiskaming and Northern Ontario Railway in 1903 ushered in the second era of silver mining in Ontario. Two workers looking for tie timber spotted some shining metal and stopped to investigate. The metal turned out to be silver and the find marked the beginning of the Cobalt silver field. There were further discoveries in the area but little excitement was generated. However, when ore was finally shipped out in 1904 and the richness of it known, a genuine rush set in. By the end of 1905 most of the finds in the Cobalt area had been made. Production rose steadily, reaching a peak in 1911 of 30 million ounces, followed by a slow decline. There were additional rich finds nearby at Lake Gowgonda, South Lorrain, and Casey townships in 1907 and 1908.

When silver production reached its peak in 1911-1912 it accounted for one-third of the value of mineral output. Today it is a relatively unimportant metal, accounting for less than 4% of total output value. And most of that output comes from mines in which silver is not the predominant metal.

An additional element of success at Cobalt is its indirect effect on the gold mining industry in Ontario. The profits from silver operations

supplied capital for development of the gold fields. And, these finds brought prospectors into the Porcupine and Kirkland Lake areas to the north of Cobalt.

The first discovery in the Porcupine area was made in 1907, but the first mine did not operate until 1909. By 1912 the Porcupine camp had produced more gold than had previously been mined in all of Ontario. The Kirkland Lake area, the second richest gold field, was producing as early as 1919. Other important finds occurred at Larder Lake in 1906, Red Lake and vicinity in 1924 and in the Crow River area in 1928. Gold mining had been relatively unimportant in the mining industry in Ontario but by 1920 the value of gold output had reached 1/4 of all metallic production; by 1931 over 50%.

In 1934 the United States raised the buying price of gold from \$20.67 to \$35.00 an ounce thus making a good deal of low grade ore profitable to mine. In 1933 there were 20-odd producers, in less than 7 years there were more than 60. It appeared that the recurrence of war would provide an added stimulus to gold production. The government had a great need for U.S. currency and so urged an expansion of the industry. However, by 1941 the need for American dollars lessened and in 1942 gold mining was classed as a nonwar industry. It consequently suffered in obtaining allocations of labour and supplies. By 1945 production had fallen 50% below the prewar level.

Faced with rising production costs but fixed output prices, in the postwar period, gold mining became less and less profitable. Capital gradually moved out of gold mining and into more attractive ventures. However, until 1966 the fall in gold production was not precipitous. Over the next four years, however, gold output fell to the point that it represented less

than 4% of the annual mineral output of Ontario. This represents a drastic change since gold accounts for almost 1/4 of the value of all metallic mineral output in Ontario up to 1964.

Nickel and copper production rose slowly following the turn of the century, though not without some minor setbacks. With the advent of the First World War, production was greatly increased. In 1915 nickel production tripled, and it continued to rise until the end of the war. Peacetime brought a large cut in output. However, production was still double its prewar level.

The year 1921 saw another large drop in production. Stocks had been piling up to meet an expected demand that failed to materialize. Nickel was still being used mainly for armour plating. However, adjustment was finally made and demand eventually rose to the point where in 1929 production had reached its wartime peak once again.

The onslaught of the depression brought the usual results; 1932 production was less than one third the output of 1929. By this time only two companies were operating in Ontario, the International Nickel Company, and Falconbridge Mines. They decided to fight the depression. The approach was to develop many new applications for nickel, produce new alloys, and undertake a vigorous sales campaign. The result of the research and sales program was a huge rise of output and sales in 1933. Output has been rising rapidly ever since then and the industry has avoided major slumps. Though Ontario's share of the world nickel market has been falling, nickel is becoming an increasingly larger component of the province's mineral production. In 1970 it accounted for almost 50% of the total value of mineral production in Ontario for that year.

With the building of blast furnaces at Hamilton and Sault Ste. Marie, iron ore production underwent a brief revival. However, by 1923 all the ore that was being processed was imported from the United States. The beginning of the Second World War again provided a change. The Helen mine was reopened in 1939 and for the first time in many years, Ontario blast furnaces treated Ontario ores. After years of drilling and some government help the Steep Rock open pit mine was brought into full production in 1945. By 1949 the Steep Rock deposit was the major ore supplier in Ontario.

Since the Second World War the iron ore mining industry in Ontario has undergone a rapid development. One of the reasons for this has been the introduction of the iron ore pelletizing process which makes possible the utilization of low grade ores. The industry has undergone such a turnaround that by 1959, 84% of the ore mined was exported to the United States. In 1965 there were twelve furnaces operating in Ontario. Some of the new deposits being worked today are those at Marmora, Bruce Lake and in the Algoma district. The value of output in 1970 was 144 million dollars making iron ore third in importance in Ontario behind nickel and copper.

Zinc, after being mined intermittently since the turn of the century, has now become the fourth most important component of mineral production. By 1968 output exceeded 100 million dollars annually with the major source being mines in the Porcupine district. The combined output of cadmium, cobalt, magnesium and platinum is only slightly less important. These are produced mostly as by-products of the mines all across Ontario.

Uranium minerals had been found in Ontario as early as 1847. However, the exact location of the earliest find is not now known. There was another discovery at Wilberforce in 1922 but the deposit was not sufficient for economical mining. The next find, in the Algoma district in 1948, met a similar

fate. There were numerous other deposits located in the area and by the mid-1950's the first mine in the Elliot Lake region began production. It appeared that the region would have a long and prosperous future, but in 1959 the United States Atomic Energy Commission ceased importing uranium. Since it was the major purchaser, production slumped. The Canadian Government's decision to stockpile the remaining output allowed a few of the mines to keep producing. From a peak output of \$268 million in 1959, production fell to \$40 million in 1970. However, demand has been increasing and has reached a point where a good uranium supply may be used as a lever in selling Candu reactors. The future of Elliot Lake, with the largest uranium reserves in the world, again looks bright.

Pulling these strands together, the annual value of Ontario mineral production since 1928 is set out in Table 1. Several trends are clear. First, since the early 1930's the share of metallic mineral output amounts to over 80% of the total mineral production. Further, the non-metallic group is almost totally structural materials: fuel production in Ontario is relatively insignificant. Because the factors affecting production and marketing structural materials differ substantially from metal mining, and the latter is far more important in total, our focus is largely on metallic minerals.

Within the metallic minerals, the once supreme gold, with its pegged nominal price, fell from over 50% of the total value of metallic mineral output in the late 1930's to about 3% in 1971 when the nominal price was set free.

Nickel, throughout the period, has been the mainstay of the metal mining industry. Output value, both absolute and relative, has fluctuated in long swings, reflecting international market conditions. Nevertheless,

with the exception of the depression era, the value of nickel output has amounted to between 28% and 45% of the provincial total. Copper, on average a little more than half as big as nickel, also shows long swings, and is currently, by historical standards, with a larger than normal share of nearly one quarter.

Iron ore production began in significant amounts at the time of World War II, but its full development was delayed until the postwar period. Again, in the mid-sixties the share of iron ore grew.

Finally, the uranium story in Ontario is well known: the rush of the late 1950's and the subsequent retrenchment. At its peak (1959), uranium production accounted for one-third of provincial metallic mineral production. The latest figures indicate that its share is now one-tenth of the peak.

(4) Government Involvement

The first step to involve the government in the mining industry was taken shortly after the union of Upper and Lower Canada. Parliament established the Geological Survey of Canada in 1841 and in 1842 it undertook a geological survey of the country. Its purpose was to aid in the development of the mineral resources. At that time there were no statutes governing mining operations. The first regulations were implemented in 1845 by Order-in-Council, and until the Gold Mining Act of 1864 this was the only method of control.

After Confederation the management of public lands was put in the hands of the Provinces. The first session of the Legislature of Ontario produced the Gold and Silver Mining Act. This Act was soon replaced by the General Mining Act in 1869. The main purpose of this legislation was to provide for the fair and efficient exploitation of mineral deposits.

Table 1: VALUE OF MINERAL PRODUCTION, TOTAL GROUPS, AND
SELECTED METALS, ONTARIO 1928 - 1973

\$ Million

Year	Total		Nickel	Copper	Iron Ore	Gold	Uranium	Non- Metallics	Fuels	Structural Materials
	Mineral Production	All Metals								
1928	99.6	71.3	22.3	8.8	—	32.6	—	3.0	4.8	20.4
1929	117.7	84.0	27.1	14.6	—	33.5	—	3.4	5.2	25.0
1930	113.5	83.3	24.5	15.2	—	35.9	—	3.2	5.3	21.8
1931	98.0	75.1	15.3	9.1	—	45.0	—	2.8	4.9	15.2
1932	85.9	69.7	7.2	4.4	—	53.5	—	2.4	5.0	8.8
1933	110.2	95.8	20.1	10.1	—	61.6	—	2.3	4.8	7.3
1934	145.6	129.0	32.1	14.8	—	72.6	—	2.5	5.0	9.0
1935	158.9	142.2	35.3	19.3	—	78.1	—	2.5	5.3	8.9
1936	184.5	165.3	43.9	26.9	—	83.3	—	2.5	6.4	10.3
1937	230.0	204.9	59.5	41.7	—	90.5	—	3.1	6.9	15.1
1938	219.8	197.9	53.9	30.4	—	101.9	—	3.1	6.8	12.0
1939	232.5	208.2	50.9	32.6	0.3	111.5	—	3.8	7.7	12.9
1940	261.5	232.8	59.8	34.7	1.2	125.6	—	4.4	8.1	16.2
1941	267.4	237.0	68.7	33.2	1.4	123.0	—	4.8	7.5	18.1
1942	259.1	230.5	70.0	30.6	1.5	106.4	—	5.4	7.1	16.1
1943	232.9	204.8	71.7	32.2	1.5	81.5	—	6.3	6.9	15.0
1944	210.7	183.9	69.2	33.8	1.9	66.7	—	6.1	5.0	15.7
1945	216.5	188.2	61.9	29.8	3.6	62.6	—	5.8	5.1	17.4
1946	191.5	157.1	45.4	22.5	6.8	66.6	—	5.2	4.9	24.3
1947	249.8	207.6	70.7	46.0	9.3	68.1	—	6.1	5.7	30.4
1948	294.2	244.5	86.9	53.4	7.5	73.3	—	6.9	7.6	35.2
1949	323.4	265.8	99.2	44.7	13.2	84.8	—	7.1	9.7	40.8
1950	366.8	302.6	112.1	54.4	17.6	94.4	—	10.4	4.1	49.7
1951	444.7	366.8	151.3	70.9	21.2	90.8	—	13.6	4.1	60.2
1952	444.7	360.9	151.3	71.0	19.6	86.1	—	13.2	4.0	66.6
1953	465.9	370.6	160.4	77.6	23.1	75.1	—	13.2	4.9	77.2
1954	496.7	395.2	176.6	81.3	20.4	80.5	—	13.1	5.4	83.0
1955	583.9	470.9	198.5	170.2	34.3	87.1	0.5	14.4	5.9	92.7
1956	650.8	521.3	208.1	128.6	44.2	86.6	9.4	18.7	6.7	104.1
1957	748.8	601.0	243.5	98.5	41.3	86.5	82.9	20.2	7.5	120.1
1958	789.6	629.3	177.2	71.3	36.9	92.3	210.1	20.4	8.6	131.3
1959	970.8	806.2	240.1	110.5	50.8	90.1	268.5	25.2	9.7	129.7
1960	983.1	817.8	277.9	123.8	48.4	92.8	212.0	25.3	9.7	130.3
1961	943.7	780.8	295.4	122.4	62.4	93.5	151.1	23.6	9.2	130.1
1962	913.3	729.8	274.2	116.3	64.5	90.6	118.3	27.3	9.5	146.8
1963	873.8	683.2	246.3	112.0	70.0	88.3	103.0	26.9	9.5	154.2
1964	904.6	701.3	267.8	131.5	85.6	81.4	63.6	24.5	9.8	169.1
1965	992.8	776.0	316.3	161.7	94.2	73.4	47.2	23.1	8.9	184.7
1966	957.8	732.4	269.5	181.4	91.7	62.6	42.8	23.7	10.2	191.6
1967	1,194.5	970.9	352.2	261.8	99.9	56.5	41.4	28.4	8.9	186.3
1968	1,355.6	1,107.7	403.6	278.3	127.9	52.0	28.5	33.4	7.6	191.7
1969	1,223.4	1,001.0	329.1	244.3	128.2	46.3	40.3	35.7	7.4	179.3
1970	1,590.1	1,354.4	608.4	340.8	144.8	42.5	40.6	40.1	9.3	186.4
1971	1,554.2	1,290.6	584.0	317.5	136.2	40.1	44.8	43.9	9.1	210.6
1972	1,534.8	1,251.5	519.9	293.5	139.5	58.7	n.a.	44.2	7.3	231.8
1973 ^a	1,779.3	1,478.9	565.1	353.8	145.0	86.9	n.a.	51.9	6.9	241.7

^aPreliminary.

Source: SC, General Review of the Mineral Industries, and Preliminary Estimate of Canada's Production, reproduced in Ontario Statistical Review, 1973.

By 1890 mining had become sufficiently important that the government appointed a commission to study the industry. It was to report upon the mineral resources of the province, examine the subject of mining laws and regulations, and enquire into how best to aid and encourage the industry. The next few years saw many of its recommendations effected. The Mining Act of 1891 created the Bureau of Mines. The Bureau, later the Department of Mines, inspected the mines, published an annual report, and in general attempted to promote mining interests in the province of Ontario. The Kingston School of Mining was created in 1893 and soon followed by summer mining and prospecting schools across the Province.

In 1907 the Federal Government formed the Department of Mines, with the Geological Survey being one of the branches. The Survey Branch supplied information on mineral sources and the other, the Mines Branch, provided information on uses of minerals and techniques of processing and extraction. Since then the Department's functions have been greatly expanded and it is now very active in research.

Government involvement has not been restricted to the provision of information. There have been numerous attempts to encourage the industry through the use of taxes and subsidies.

Both the Federal and Provincial governments have desired to establish a permanent iron smelting industry in Canada. The first iron smelters were offered cheap supplies of wood. By 1883, Ottawa was offering bounties of \$1.50 per ton of pig iron produced from Canadian ore. The bounties existed in various amounts and on different iron products until 1912. At the time they ceased the Dominion had made payments totalling over \$16 million. In 1894 the Ontario Government instituted an Iron Mining Fund of \$125,000. It paid producers a bounty of \$1 per ton of pig iron if the ore

had been mined and smelted in Ontario. The fund was exhausted in 1904 and never renewed. In order to encourage the mining of iron ore, an Act was drawn up in 1900 which stated that unless a mine produced 20,000 tons of ore in ten years ownership of the mine would revert to the Crown. The Act was never proclaimed. In 1922 the Provincial Government appointed the Iron Ore Committee and its recommendation resulted in the restoration of bounties on iron production. The efforts to establish the iron industry in Ontario were all ineffective, however: by 1923 all iron ore production ceased.

The idea that nickel refining should be carried on in Canada was also popular with both levels of government. The Canadian Government gave the Governor-in-Council power to impose a duty of 10 cents per pound on unrefined nickel and 2 cents per pound on unrefined copper exported from Canada. The power was given in 1900 but never used.

At that same time the Ontario Government gained authority to impose an export levy of \$10 per ton on nickel ore and \$7 per ton on nickel-copper ore exports. Similarly, this power was never used. In 1907 the Ontario Legislature instituted the Metal Refining Bounty Act. This Act provided a bounty on production of 6 cents per pound on refined nickel and 1 1/2 cents per pound on refined copper to be paid to the refiners. The bounty was to last 5 years but was extended another five years until 1917. Again, little success was achieved. In 1915 the Royal Ontario Nickel Commission was formed to examine the nickel question. However, before its report was published The International Nickel Company had begun erecting a refinery at Port Colborne.

The Emergency Gold Mining Assistance Act of 1948 is another example of production subsidies. The effects of World War II, rising costs in the face of fixed prices, put the gold mining industry into a very difficult position. In order to help the industry the Federal Government implemented

this Act. It gave subsidies based on a sliding scale depending upon average costs of production. This program helped all gold mines but gave the greatest support to the marginal producers.

The development of radium as a cure for cancer created a high demand for radioactive minerals. In order to establish production in Ontario, the Province offered a \$25,000 bounty to any prospector who found a deposit. The bounty was first offered in 1914. However, the deposit had to be of commercial value: no money was ever collected.

The Ontario Government on one occasion attempted to operate a mine directly. It sent a search party into the Cobalt area which found a silver deposit in 1906. However, the operation proved to be difficult and was soon sold for a small profit.

The mining industry has long been regarded as a source of revenue. In 1862 the Province of Ontario instituted the first royalty. It was a payment of 2 1/2 percent of the market value of ore mined. In 1864 it was changed to a tax of \$1 per ton on all ores except those of silver or gold. In both cases, the royalty was based on the ore value (weight) at the mine. By the following year the tax was abandoned.

The Gold and Silver Mining Act of 1868 placed a royalty of between 2 percent and 10 percent on the refined value of gold and silver; however, the General Mining Act of 1869 saw them cancelled again. The rich finds at Sudbury renewed the Government's interest in obtaining revenue from the mining industry. The result was a reintroduction of royalties in 1891. They consisted of 3% on silver, nickel, and copper ores, less than 2% on iron and less than 3% on all other ores. These royalties appear to have been based on ore value at the mine. They were reduced in 1894 and eliminated altogether in 1900.

In 1907 the Province of Ontario instituted the Supplementary Revenue Act. The Act imposed a tax of 3% on profits exceeding \$10,000 per annum, a tax of 2 cents per acre of mining property in unorganized districts and a tax of 2 cents per 1000 cubic feet on natural gas exported from the Province. The receipts under the Act for 1907 totalled \$43,000. In 1914 the Act was revised and renamed the Mining Tax Act. The acreage tax was increased to 5 cents and the profits tax rate on profits exceeding \$1,000,000 was increased. The new rates are noted in Table 2 which also shows the rates set in subsequent years.

During the period 1914 to 1924 a separate schedule for nickel-copper was maintained at 5% on profits greater than \$10,000 and less than \$5,000,000: beyond \$5,000,000 the ordinary schedule applied. In 1924 the tax schedule was unified.

In 1930 the progressive structure of the tax was truncated at a maximum marginal rate of 6%. Nevertheless for an extended period the principle of a progressive structure was retained. However, this was abandoned briefly in 1969 when the tax free base was raised to \$50,000, and a uniform rate, as recommended by the Smith Committee (Ontario, 1967), was set at 15%. In the 1974 Budget a progressive schedule was reintroduced. The new schedule is contained in Table 3. We shall have more to say about the 1974 changes at a later point in this study.

The revenue obtained from the mining profits tax has grown with the growth of the industry. In 1930 the tax generated revenue of about \$400,000. The estimated receipts from the same tax in 1973-74 (before the new rates) amount to some \$45,000,000.

Table 2 : The Mining Profits Tax in Ontario:

Marginal Tax Rates

Profits	Marginal Tax Rate on Profits			
	1914	1930	1947	1958
0 to \$10,000	0%	0%	0%	0%
next \$990,000	3%	3%	6%	6%
next \$4,000,000	5%	5%	8%	11%
next \$5,000,000	6%	6% max. marginal rate	9% max. marginal rate	12% max. marginal rate
next \$5,000,000	7%			
subsequent \$5 million increments	add 1% increments			

Table 3 : New Mining Profits Marginal Tax Rates, 1974

Profits	Marginal Tax Rate on Profits
0 to \$100,000	0%
next \$900,000	15%
next \$9,000,000	20%
next \$10,000,000	25%
next \$10,000,000	30%
next \$10,000,000	35%
over \$40,000,000	40%

In modern Ontario, government involvement is embodied in three major instruments: a substantial Division of Mines in the Ministry of Natural Resources, the Mining Tax Act, and the Mining Act.

The Division of Mines in the Ministry of Natural Resources has a staff of some ninety officers in four major branches. The geological branch provides detailed mapping and research to individuals engaged in exploration and development of Ontario's mineral resources. The mines engineering branch is charged with ensuring the safe operation of Ontario mines. A mineral research branch runs testing laboratories. Finally, a mineral resources branch provides the government with specialists' advice on the industry.

The Mining Tax Act governs the mining profits tax and related matters. We take this up in detail in Part III below.

The Mining Act covers a great variety of details concerning the regulation of the sector. There are articles governing the management of public lands: assessment work, forfeiture of claims, inspection, leasing, licences, mining claims, mining rights, patents, penalties, prospecting, surface rights, on through water claims. One part governs the operation of mines. Another part deals with refining. Of major interest for our analysis are the processes of acquisition and reversion of mineral rights. We turn to this in the next section.

2. Setting of Sector

The development of the Ontario mineral extraction sector, as we have just described it, has created a substantial modern-day segment of the provincial economy. Out of a Gross Provincial Product (GPP) amounting to some \$37.8 billion in 1971 (Table 4) mineral extraction accounted for some \$717 million value added. (Statistics Canada, 61-202, 1971). Relative to other goods-producing sectors of the provincial economy, value added in mineral extraction is about the same as in agriculture, and a little larger than in electric power generation. Mineral extraction value added is about one-quarter that of the construction industry, and about one-sixteenth that of manufacturing. (See Table 5. Note that the goods producing industries account for about 43% of GPP).

The real output of the Ontario mineral sector in the decade to 1971 exhibited considerable instability around a moderate upward trend. To examine this growth we have constructed in Table 6 a consistent data series in real terms for the period 1962 through 1971.¹ The output measure is value added in the Ontario mineral industry at constant 1966 prices.

While real output was fluctuating, during the same period the number of employees remained nearly constant. Hence, if we employ as a crude measure of labour productivity, real value added per employee (Table 6, column 3), we find again an instability around the upward trend.

¹It proved impossible to carry the measures back any further because of changes in the construction of key series, while years later than 1971 were not yet published.

Ontario mining value added is a large, but declining, proportion of the Canadian total mining value added, standing at 18.8% in 1971, down substantially from the 30% of the early 1960's (see Table 7). In most other sectors, Ontario accounts for a larger share of the Canadian total. Ontario manufacturing, construction, electric power, and agriculture all have a larger share of the Canadian total: Ontario forestry and Ontario fisheries have a smaller share.

Although Ontario's mineral production in general, and mining in particular, are relatively small vis-à-vis manufacturing, a province-wide comparison masks considerable regional concentration of mining in certain locations. This is shown clearly in Table 8. Over 85% of 1970 Ontario mineral production was in the northern part of the province, with the northwestern part (the counties of Cochrane, Nipissing, Timiskaming, Sudbury, Manitoulin, and Algoma) accounting for 76.5% of provincial production. This significant regional concentration of activity is a very important feature of the sector and tempers many of the policy considerations bearing on it.²

The absolute and even relative size of mineral extraction gives us one dimension of the sector. A further dimension of considerable significance concerns the linkages the sector has with the rest of the provincial economy. The latest provincial input-output table (1965) has a separate entry for the mining sector. The table shows mining as drawing inputs from several other industries, the principal outside suppliers identified as being the chemical sector (largely for blasting) at 4.6% of output value, the transportation and trade sector at 4.2%, metal industries (largely equipment) at 3.0% and the "other services" industry at 8.9%.

Compared with other sectors "backward" linkages in mining are very limited, reflecting the nature of the production process which does not draw

² The most important policy in this regard is promotion of processing in Northern Ontario. See discussion of justification of processing incentives, p. 38 below, and discussion of structure of processing incentives, pp. 69-76 below.

Table 4 :

PROVINCIAL INCOME AND GROSS PROVINCIAL PRODUCT, ONTARIO, 1960 - 1972
DOMESTIC CONCEPT
\$ Million

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972 ^a
1. Wages, salaries and supplementary labour income	8,225	8,518	9,130	9,774	10,660	11,840	13,433	14,809	16,374	18,424	20,138	22,137	24,430
2. Military pay and allowances	172	189	201	206	208	205	229	253	280	287	288	277	290
3. Corporate profits before taxes	1,671	1,755	1,903	2,192	2,546	2,793	2,976	3,031	3,461	3,686	3,477	4,030	4,800
4. <i>Deduct:</i> Dividends paid to non-residents	-309	-354	-381	-431	-494	-538	-566	-579	-586	-616	-650	-668	n.a.
5. Interest and miscellaneous investment income	447	480	574	632	653	696	800	912	1,013	1,151	1,210	1,346	1,480
6. Accrued net income of farm operators from farm production	268	276	319	283	268	300	423	328	338	371	321	268	385
7. Net income of non-farm unincorporated business including rent	1,277	1,329	1,367	1,455	1,491	1,578	1,663	1,782	1,978	2,163	2,221	2,347	2,576
8. Inventory valuation adjustment	-8	-19	-41	-95	-58	-141	-144	-144	-154	-253	-96	-278	n.a.
9. <i>Net Provincial Income at Factor Cost</i>	11,743	12,174	13,072	14,016	15,274	16,733	18,814	20,392	22,704	25,213	26,909	29,459	n.a.
10. Indirect taxes less subsidies	1,842	1,975	2,236	2,368	2,620	3,099	3,345	3,724	4,125	4,606	4,820	5,310	n.a.
11. Capital consumption allowances and miscellaneous valuation adjustments	1,717	1,722	1,854	1,994	2,215	2,438	2,669	2,909	3,080	3,365	3,720	4,007	n.a.
12. Residual error of estimate	-664	-511	-827	-583	-566	-609	-355	-689	-694	-661	-461	-999	n.a.
13. <i>Gross Provincial Product at Market Prices</i>	14,638	15,360	16,335	17,795	19,543	21,661	24,473	26,336	29,215	32,523	34,988.	37,777	42,400

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^aPreliminary dataSource: Ontario Ministry of Treasury, Economics and Intergovernmental Affairs, reproduced in Ontario Statistical Review, 1973.

Table 5: INDUSTRIAL DISTRIBUTION OF ONTARIO'S COMMODITY PRODUCTION, 1960 - 1971^a
 (Percentage Distribution of Census Value Added in Goods-Producing Industries)

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Secondary Industries	81.9	79.9 ^a	81.5	83.1	83.9	84.5	85.1 ^r	84.9 ^r	84.8 ^r	85.6	84.5 ^r	86.6
Manufacturing	66.3	67.9 ^a	69.7	71.2	72.3	72.7	71.4 ^r	71.0	71.3 ^r	71.9	69.6	70.6
Construction	15.6	12.0	11.8	11.9	11.6	11.8	13.7	13.9 ^r	13.5	13.7	14.9 ^r	16.0
Primary Industries	18.1	20.1	18.5	16.9	16.0	15.5	14.9 ^r	15.1 ^r	15.2 ^r	14.4	15.5 ^r	13.4
Electric Power	3.9	4.0	3.8	3.7	3.5	3.4	3.3	3.4	3.5	3.5	3.9	3.9
Mining	5.6	7.1	6.1	5.5	5.5	5.1	4.1	5.0	5.3	4.4	5.6	4.4
Forestry	1.7	1.5	1.3	1.0	0.9	0.9 ^r	0.9 ^r	0.8 ^r	0.7 ^r	0.8	0.7	0.6
Fisheries	0.1	0.1	0.1	0.1	0.1	0.1	-	-	-	0.1	-	-
Trapping	-	-	-	-	-	-	-	-	-	-	-	-
Agriculture	6.8	7.4	7.2	6.6	6.0	6.0	6.6 ^r	5.9 ^r	5.7	5.6	5.3 ^r	4.5
Total Non-Agricultural Industries	93.2	92.6 ^a	92.8	93.4	94.0 ^r	94.0 ^r	93.4 ^r	94.1 ^r	94.3	94.4	94.7 ^r	95.5

Notes:

^a Adoption of the 1960 Standard Industrial Classification has brought about changes in data for mining and manufacturing from 1959 onward and again in manufacturing from 1961 onward. As a result the series for these statistics and for totals which include these statistics are discontinuous at 1959 and 1961.

^r Revised.

Source: SC, Survey of Production, reproduced in Ontario Statistical Review, 1973.

Table 6: REAL VALUE ADDED, EMPLOYMENT

ONTARIO MINERALS, 1962 THROUGH 1971

Year	Value Added, 1966 Prices (\$,000)	Employees, Total Number	Real Value Added per Employed (\$,000)
1962	408,037	33,204	12.3
1963	389,522	31,511	12.4
1964	600,075	31,055	19.3
1965	585,231	31,687	18.5
1966	505,353	31,582	16.0
1967	620,227	31,484	19.7
1968	709,120	32,826	21.6
1969	574,797	29,096	19.8
1970	656,696	33,308	19.7
1971	574,143	33,550	17.1

Sources: a) Value added at current prices and number of employees are from Statistics Canada, Principal Statistics of Mineral Industries. The data cover the mineral extraction activity through the concentrating stage, but exclude the smelting and refining stage.

b) Value added deflator was constructed using disaggregated price and output data from the Annual Report on the Ontario Mineral Industry. The disaggregated data covered the following minerals: bismuth, cadmium,

calcium, cobalt, copper, gold, iron ore, lead, magnesium, nickel, platinum, selenium, silver, tellurium, thorium, uranium, yttrium, zinc, arsenic, asbestos, gypsum, nepheline syenite, peat moss, quartz, sulphur, talc, mica, sand, stone, natural gas, and petroleum. Salt, cement, lime and clay are excluded because they are not included in the Statistics Canada definition of minerals. For each individual mineral, the 1966 unit value was computed and multiplied by the quantity of production series to obtain a value of output series at constant 1966 prices for that mineral. The deflator consisted of the ratio of the sum of these individual value series at current prices to the sum at constant 1966 prices. The deflator was then applied to the Statistics Canada current price series of the provincial sector value added to obtain the series in the table of Ontario mineral value added at 1966 prices.

Table 7: ONTARIO PERCENTAGE OF CANADA CENSUS VALUE ADDED IN GOODS-PRODUCING INDUSTRIES,
1960 - 1971^a

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
All Commodity-Producing Industries	41.3	42.0	41.2	41.6	42.0 ^r	42.0 ^r	41.7	42.7 ^r	42.8	42.5 ^r	42.7 ^r	42.4
Secondary Industries	46.0	46.7 ^a	47.5	48.5	48.5	48.4	48.6	48.7	49.0	48.8 ^r	48.7	48.7
Manufacturing	50.3	50.3 ^a	50.9	51.9 ^r	52.2	52.8 ^r	52.9 ^r	53.1	53.0	52.8	52.5	53.3
Construction	33.8	33.2	34.1	34.9	33.5	31.9	34.2	34.2	35.0	34.9	36.4	35.5
Primary Industries	27.9	30.5	26.0	24.5	24.6	24.3	23.0	25.2	25.1	25.1 ^r	25.3	25.4
Electric Power	38.0	37.1	36.3	35.8	35.4	35.8	35.4	34.6	34.6	34.7	34.2	34.3
Mining	30.5	31.4	27.0	24.4	23.5	22.3	19.2	22.3	22.8 ^r	19.6 ^r	22.1 ^r	18.8
Forestry	19.2	17.3	15.8	17.7 ^r	16.1	16.1 ^r	17.3 ^r	16.7 ^r	15.3 ^r	15.2	16.2	15.5
Fisheries	5.0	5.2	4.1	4.2 ^r	3.5	4.0	3.4 ^r	3.6	3.2 ^r	4.0	3.2	3.4
Trapping	22.9	21.1	23.7	28.3	30.2	24.6 ^r	29.0 ^r	25.0	27.6	30.2	26.2	24.7
Agriculture	26.3	31.6	25.6	22.5	24.4	24.7	24.1	27.6	26.9	27.3	28.8	24.3
Total Non-Agricultural Industries	43.0	42.6 ^a	42.7	43.6	43.9	43.9	43.9	44.1	44.1 ^r	44.0	43.8	43.9

^aAdoption of the 1960 Standard Industrial Classification has brought about changes in data for mining and manufacturing from 1959 onward and again in manufacturing from 1961 onward. As a result the series for these statistics and for totals which include these statistics are discontinuous at 1959 and 1961.

^rRevised.

Source: SC, Survey of Production.

Table 8 : Regional Distribution of Ontario
Mineral Production, 1970
(\$ million and percent)

Economic Region	Production Value	Percent
Metropolitan	58.5	3.7
Niagara	24.8	1.6
Eastern Ontario	19.6	1.2
Northeastern Ontario	1,217.1	76.5
Lake St. Clair	27.8	1.7
Lake Erie	24.1	1.5
Mid Western	25.7	1.6
Lakehead/Northwestern	141.3	8.9
Lake Ontario	45.2	2.8
Georgian Bay	6.0	0.4
Total*	1,590.1	100.0

Source: Ontario, Annual Statistical Report on the Mineral Production of Ontario.

Note: Totals may not add due to rounding.

heavily on intermediate inputs. Value added accounts for some 57.4% of output, and "unallocated sectors" form another 10.7%. Food products, by contrast, have a value added portion of only 21.8%.³

The mining sector's output goes almost entirely to processing activities or to exports. These "forward" linkages again reflect the nature of the mining activity: further processing either at home or abroad is required before the output is much use to most other industries. Thus, some 72.4% of deliveries to intermediate demand were to the two industries labelled iron and steel mills, and petroleum and coal products. It is also worth noting that exports as a percent of total output amounted to some 84.3%. No other sector had such a high export ratio. The next closest was the clothing industry which, although a net importer, had gross exports amounting to 76.0% of total output. (Ontario, 1973).

A final set of observations concerning the Ontario mineral sector relates to foreign ownership and control. There are a variety of measures of the foreign presence, all of which point to the same conclusion for mining: it is heavily foreign dominated. The basic source of data is CALURA.(Statistics Canada, 61-210, 1974).

The use of CALURA data for mining gives a reasonable approximation of the overall picture, for some 99% of corporate mining assets are included. It

3. These data are drawn from the Ontario input output table for 1965. See Direct Requirements Table (Ontario, 1973, 38).

seems reasonable to assume that unincorporated mining activity is not very large. The use of CALURA data to make statements concerning the overall proportion of foreign ownership and control in other sectors leads to unknown biases because significant portions of other sectors are not included in CALURA because they are either not incorporated or they are too small to report under CALURA. Drawing on the 1971 CALURA data for all mining, foreign controlled firms had:⁴ 71% of taxable income in Ontario; 70% of assets in Canada; 76% of sales in Canada; and 80% of profits in Canada. Among the foreign owners in the mining sector, the United States was by a wide margin the major foreign source for both Ontario and Canada. Of the 71% of taxable income attributable to foreign controlled enterprises in Ontario, some 69 percentage points were attributable to U.S. controlled firms, and only 2 percentage points to other foreign controlled firms.

For the present we simply note this substantial foreign domination of the sector. In subsequent parts of the study we consider some of the reasons for and the consequences of the present ownership structure.

⁴ We should also add a word of caution concerning the meaning of "control" in CALURA statistics. A firm is defined as controlled with more than 50 % ownership. However, a smaller concentrated group, either foreign or domestic, may exercise de facto control. A priori the bias arising from this definition is ambiguous.

II. The Economic Policy Framework

The stage is now set for us to focus on the fundamental issues involved in economic policy choices. We want to know what sorts of policy action are justified, and why. The most convenient way to do this is to consider first the conditions that would result in achievement of an ideal situation. The next step is to evaluate the extent to which actual conditions correspond to those ideal conditions. Clearly, if there are actual conditions that do not take us to the ideal state, there is a potential case for policy action. Finally, we will want to know how actual and proposed policies correspond to the case for policy action. This latter evaluation follows in Part III.

1. Analytical Framework

What would the ideal situation look like? To answer this we need to agree on our objectives. As a first approximation, we take our fundamental objective as obtaining the maximum present value of Ontario real income now and in the future.⁵

Economic theorists have worked out in some considerable detail the way an economy must function for this objective to be achieved. These can be stated very simply as perfect competition in all relevant domestic markets.

A market is perfectly competitive if an individual buyer or seller has no influence on the market price. Consequently, each participant in the

⁵ As a supplementary point, we might add the constraint that there be an equitable distribution of the income generated. The issue of income distribution policy, however, is far broader than the initial distribution of income from one small portion of the provincial economy. We therefore only take it into account indirectly in what follows.

We should also note that economists are engaged in debate about whether the maximum income objective is appropriate. We do not intend to enter that debate here. Rather, we adopt the most widely accepted maximum income objective as a valid first approximation for use in evaluating public policy.

market takes prices as given to him.

When each participant can take prices as given, and acts in his own interests, several things will follow. It is useful to consider these consequences in terms of three important aspects of minerals activity. These aspects are: (1) production, (2) domestic use, and (3) rate of exploitation.

Perfect competition will ensure that there is production efficiency. This means first that all available factors of production are used in such a way that it is not possible to increase mineral output without reducing output in some other sector of the provincial economy. Production efficiency means more than this technical efficiency. It means also that for a given set of prices, the mix of outputs between minerals and other possible outputs is of maximum value. Hence, any production change from a situation of production efficiency would mean that the value of whatever output is increased would be worth less than whatever output is reduced. The new set of outputs thus would be worth less than the initial set.

To succeed in producing efficiently is only half the battle. We must also concern ourselves with the use to which we put the outputs we produce. Perfect competition will also ensure that there will be efficient domestic use of output. This means that no user will value minerals any less (or more) than any other user. Hence, there is no economic reason for one user of minerals to be more wasteful than another. A further dimension of domestic use efficiency refers to the overall mix of domestic use between minerals and other things. For a given set of prices, efficient use means that it is impossible to alter the mix between domestic use of minerals and domestic use of other things in a way that would increase the satisfaction of domestic users as a whole.

Our discussion has so far referred only to the current situation.

In formulating our policy towards use of potentially non-reproducible minerals we must add a third aspect to the discussion. This refers to the intertemporal decision about the rate of exploitation. Our maximum income objective is stated in terms of each point in time, now and in the future. We do not want to achieve a high income now at the expense of future incomes, nor do we want to accept an unduly low income now just to achieve high future incomes. We want to use our mineral wealth efficiently over time so that in each year, now and in the future, the value of a ton of minerals in situ is the same.⁶ To provide a consistent way of comparing values over time, we state the relevant values in terms of discounted present values.

Perfect competition will ensure that there is intertemporal efficiency. The present discounted value of a ton of minerals in situ this year will be equal to the appropriately discounted present value of the ore in situ next year, and similarly for each future year. The rate of exploitation would be too fast if the present discounted value of minerals next year were greater than this year's: it would pay to leave more in the ground for next year.

For a self-sufficient economy, production, domestic use, and intertemporal efficiency are all achieved by a system of perfect competition, and the maximum income objective will be assured. However, if the province sells some of its mineral output outside the province, it may be possible to increase provincial income by departing from perfect competition. This arises if the province as a seller finds it possible to increase the relative value of provincial sales of minerals by restricting sales outside the province--clearly a departure from perfect competition. This departure is relatively easily accomplished, while retaining perfect competition in the provincial economy, by the use of an ad valorem export tax to collect for the province the difference between the actual competitive price and the desired monopoly price.

6. Alternatively, this condition may be stated as requiring that the discounted present value of the net price (net of extraction costs) be the same for all years. It should also be noted that the focus of our discussion is the long-run equilibrium. Thus, our conditions refer to the characteristics that will yield the optimal long-run equilibrium. As is the case for any market, the short-run dynamics may involve movement off the long-run equilibrium path.

2. The Case for Policy Intervention

The case for policy intervention rests, ultimately, on departures of the actual state from the ideal. The task at hand, then, is to determine the extent to which the idealized state of perfect competition in all relevant domestic markets is achieved.

It is useful to organize our discussion in terms of the three major aspects of mineral activity: production, domestic use, and rate of exploitation. In each we will want to establish whether or not there is a specific reason for policy intervention in Ontario minerals sector. Further, we will want to know if each specific case for intervention can be translated into a particular change in a well-defined variable that will result in correction of the problem.

First, on the production side, is there any reason to believe that we are not achieving efficiency in production? Two major areas clearly merit consideration as potential cases:⁷

- (a) the alleged relatively riskier nature of mineral production; and
- (b) the presence of substantial foreign investment and controls in the sector.

(1) Risk

A growing body of theoretical and empirical literature is taking up the role of risk in resource allocation. Without going into a detailed survey

⁷ Another potential area of interest is the matter of pollution generated by minerals production. A reasonably complete treatment of the pollution issue would, however, take us far beyond the scope of this study. Further, it is treated in considerable depth by D. N. Dewees, C. K. Everson, and W. A. Sims, Economic Analysis of Environmental Policies, Ontario Economic Council Research Studies, University of Toronto Press, 1975.

of that literature, it is possible to indicate the theoretical significance of risk for our analysis. Risk averse producers respond to uncertainty in product or factor markets by: (a) producing less than they would in the certainty case; and (b) by extracting a reward or premium for risk-bearing in the form of a higher rate of return than they require in the certainty case. ((See Fama & MacBeth (1973), Sandmo (1971) and Batra and Ullah (1974))

If there is evidence that the mineral sector is relatively more risky than other sectors, we will have to modify our analysis. This raises the complex issue of how to measure riskiness. One measure is the variation of profits. To examine this issue we require a measure of profits that is reasonably consistent between industries. The measure we have chosen for this purpose is "base profits" on total assets. "Base profit" is a term employed by Statistics Canada, designed to provide a consistent measure of profits unaffected by tax concessions. It includes in profits depreciation, depletion and amortization, provision for current and deferred income tax, non-cash allowances, and provisions charged against profit. The base profit rates for a few important sectors are tabulated in Table 9.

The appropriate measure of variability is a complex issue that has generated considerable debate in the literature. Recently, there has been general acceptance of a measure that refers to the riskiness of the return on a particular asset vis-à-vis the entire portfolio. It is called the β

Table 9 : BASE PROFIT RATES ON TOTAL ASSETS, CANADA, SELECTED INDUSTRIES, 1962-73 (per cent).

Year	All Indus- ties	Total Mining	Metal Mining	Mineral Fuels	Other Mining	Manu- facturing	Trans- portation
1962	11.1	13.1	13.7	11.2	15.7	12.5	8.6
1963	11.9	12.9	12.8	12.3	16.2	13.4	9.1
1964	12.6	15.0	16.5	12.5	15.7	14.0	10.5
1965	13.1	15.8	16.4	14.3	5.8	14.1	12.0
1966	12.5	14.6	14.8	13.6	17.4	13.3	11.9
1967	11.6	14.5	14.8	14.0	15.2	11.8	10.6
1968	11.7	14.3	14.6	13.6	15.0	12.4	10.7
1969	11.4	12.8	13.4	12.1	13.3	12.5	10.1
1970	10.6	14.4	15.6	13.6	12.1	10.4	9.8
1971	11.2	12.4	10.0	15.5	12.3	12.1	8.2
1972	12.0	11.5	9.3	13.9	13.3	13.1	10.8
1973	14.4	17.8	17.5	17.8	19.5	16.1	10.9
Mean	12.0	14.1	14.1	13.7	14.3	13.0	10.3
Vari- ance	1.06	2.89	6.20	2.99	11.70	1.99	1.39
β co- efficient		1.10	1.11	.96	1.55	1.19	.64

Source: D.B.S., Industrial Corporation Financial Statistics.

coefficient.⁸ If we interpret the relevant "portfolio" as all industries,

and each industry has an "asset", we can compute the relevant β coefficient for each industry in Table 9.

The results are very interesting. There is higher variance in mining than manufacturing. However, the covariance between profit rates in each industry with profit rates in all industries is higher in manufacturing than in mining, with the result that the β coefficient in manufacturing exceeds that in mining. In other words, the evidence suggests that mining is not any riskier than manufacturing.⁹

The conclusion is clear. The alleged riskier nature of mining activity is not borne out by the evidence, and hence is not a basis for policy intervention.¹⁰

⁸ See Fama and MacBeth, (1973). Formally, $\beta = [\text{cov}(R_i, R_m)]/\sigma^2(R_m)$ where R = the rate of return, and the subscripts i and m are the individual asset and the portfolio respectively, cov is the covariance, and σ^2 is the variance.

⁹ The β coefficient for transportation is substantially less. However, this sector is dominated by activities subject to detailed rate regulation. Both the variance and the mean profit rate are much lower.

¹⁰ Even if the mining industry were riskier, it would remain to establish a case for intervention. In fact, while historically the allegedly riskier character of mining was used to justify special concessions, we shall see below (pp. 76-78) that current tax policy contains very few special concessions. Thus current policy corresponds reasonably closely to the current case for policy intervention in the sector.

(2) Foreign Investment

The question we are posing here relates to the issue of whether or not the level of output in the mineral sector is significantly different due to the fact that we permit substantial foreign investment in the sector.¹¹

There is a distinct possibility that taxation or regulation in the foreign investor's home country would alter the level of output in Ontario. The tax and regulatory policies in foreign investor's home countries are formulated primarily in response to their national interests. A private foreign corporation operating both in Ontario and its home country will, in its own private interests, respond to taxes and regulations decreed by its home government. Whether or not such responses will be in Ontario's interest cannot be stated a priori. In fact the precise outcome depends so much on the particular set of circumstances that the analysis of the topic can readily become taxonomic. However, two general types of cases do merit attention.

First, there is the matter of foreign taxation of foreign-owned companies. The key issue is the nature of the treaties between Canada and the home countries of the investors. In most relevant cases there is a double taxation treaty that permits foreign-owned companies to expense taxes paid in Canada in computing their foreign tax liability. Hence, if the foreign tax rate is equal to or greater than the Canadian, the foreign-owned companies effectively face the rate of tax set by their home governments. As a practical matter, however, the foreign and Canadian tax rates are generally sufficiently close to make the possible effect of such differences insignificant. Nevertheless,

¹¹ We are not concerned with the issue of whether or not the overall level of foreign investment in the province or country is optimal in some sense.

in particular circumstances significant differences may arise, warranting a Canadian and/or Ontario policy response.

Second, we must note the fact that foreign regulatory measures might affect the Ontario operations of foreign-owned companies. Specific responses, however, depend on the specific circumstances. The key question to be asked in each case is whether or not the foreign regulatory actions distort Ontario production, use, or rate of exploitation away from the optimal.

(3) Use Side

The output of Ontario mines is not immediately sold for final consumption. Some further processing, either in Ontario or elsewhere, is always required before the products of our mines are ready for use. A major and continuing debate concerns whether or not further processing of Ontario minerals in Ontario should be promoted.¹²

¹²In addition to the arguments cited in the text there are two naive arguments frequently encountered in the debate over processing incentives. One such argument favors further processing to "maximize value added from minerals in Ontario." Such an argument ignores the fundamental economic point that an increase in processing in Ontario involves a cost. The appropriate objective, as we have already noted, is to maximize value added from all Ontario economic activities, not just one sector. Hence, if we are planning to increase the processing activity in Ontario, we must ask whether or not the value of the increased value added in processing minerals is greater than the value of reduced output from other activities in the province. Normally, the answer would be no: to achieve further processing requires special incentives, and therefore costs more to achieve than it yields in benefits.

On a level of sophistication similar to the argument just cited, the kind of activity people work at is held to be important beyond the income they receive from it. It is thus considered undesirable to have people engaged in the long-standing Canadian role of "hewers of wood and drawers of water," and desirable to have people engaged in more respectable activities such as refining metal. Put in these terms, of course, the argument has no serious merit to it.

In a similar vein to this is the argument favouring greater secondary industry in Ontario relative to, say, mining. This is extended uncritically to take in smelting and refining as a desirable secondary industry to encourage. However, it is seldom made clear why, even if we accept the objective of furthering secondary industry in general, we should choose industries on the basis of some random criterion such as whether or not the raw materials happen to be produced locally. The choice among secondary industries, more appropriately, would be based on efficiency criteria.

The basic justification for policy intervention to promote further processing of minerals in Ontario is to achieve greater diversification of the economic base in regions of the province that are otherwise heavily dependent on mineral extraction. Diversification of the economic base of a region involves fundamentally the same choice of diversification of an asset portfolio: risk is reduced at the cost of a lower return on the diversified portfolio.

There are two ways the risk may be reduced:

- (a) Income is generated in more than one activity, and if one activity is hit by a slump, the total income is not reduced as much as a slump of the same magnitude hitting the only activity.
- (b) The ability of people to switch to other activities is enhanced by their acquisition of transferable skills.

In the specific context of the Ontario mineral sector, how important are these potential gains likely to be? The income diversification objective is not promoted precisely because further processing of Ontario minerals in Ontario increases rather than decreases the dependence on the international minerals market. Similarly, the labour market skill objective is not promoted by further processing of Ontario minerals. Modern mining employs mining equipment operators and tradesmen that have a mix of skills not significantly less portable than the skills employed in tending processing machinery. Hence, it is fair to conclude that on both the income and the skill portability grounds, there is no case for promoting further processing of Ontario minerals in Ontario.

There remains a different class of reasons why further processing might be an acceptable policy objective. We live in a world where it is seldom possible to achieve first-best solutions. Hence, when it is not possible to achieve some other objective directly, it may be possible to achieve that other objective indirectly by promoting further processing.

Perhaps the most obvious example arises when measures to encourage further processing are employed primarily as a device to achieve regional income redistribution. All policy alternatives considered reasonable may already be in use to the extent regarded as politically possible, and yet the goal of augmenting real income in specific regions may not be achieved. In such a case, the interregional equity objective may be achieved only by an efficiency loss associated with a policy of encouraging further processing in those regions.

An additional example of this type of reason for encouraging further processing arises when it is recognized that a substantial portion of the affected firms are foreign owned. To the extent that processing requirements squeeze profits of the foreign owners without seriously affecting their level of operations, the processing requirement is a device transferring income from foreigners to Ontario. Over small ranges, the device may well prove successful, where explicitly differential treatment in the tax system may not be acceptable. However, it is important to note that the effect is achieved only by foregoing revenues.

A similar type of indirect reason for using processing requirements arises in conjunction with the exercise of Ontario's potential monopoly power. An explicit exercise of the monopoly power may not be feasible, either because Ontario does not have the constitutional power or because

foreigners would retaliate. Over small ranges, processing requirements may well prove to be a useful way of squeezing some monopoly return from foreigners at a relatively low cost to Ontario. In all cases, however, the efficiency cost should be recognized.

(4) Terms of Trade

Ontario has a significant share of the total world market of one important mineral, nickel. This places in Ontario's hands some latent monopoly power that might be exercised to Ontario's benefit. To reap the monopoly profit, Ontario would have to contract its own sales, thus forcing up the world price, to collect the higher world price on its own remaining world sales.

Beyond identifying the theoretical possibility, several issues remain. First, how great is the monopoly power, and is it likely to remain at current levels? The extent of monopoly power depends on three major elements: (a) the share in the total market; (b) the responsiveness of competing producers to price changes; and (c) the responsiveness of users to price changes.

Less than a decade ago, Ontario's share of the "free world" nickel production was over 50%, but has fallen off rapidly as new sources have come into production (see Table 10). Recent estimates of production in the U.S.S.R., Cuba, and Poland indicate that these Soviet bloc countries produce an additional 26% of "free world" output (Gauvin, 1974). Hence, the 1973 Ontario "free world" share of 36.1% cited in Table 10 is in fact about 28.7% of total world output.

Table 10: ONTARIO, CANADIAN AND OTHER LARGEST PRODUCER SHARES, IN "FREE WORLD" MINERAL PRODUCTION, 1968, 1972 AND 1973
(per cent)

Mineral	Ontario	Canada	1973			1972			1968		
			Next or Largest (Country)	Ontario	Canada	Next or Largest (Country)	Ontario	Canada	Next or Largest (Country)	Ontario	Canada
Nickel	36.1	49.5	21.3 (New Caledonia)	43.0	60.0	23.0 (New Caledonia)	51.0	61.8	17.0 (New Caledonia)		
Zinc	8.9	27.0	10.4 (U.S.A.)	9.0	29.0	12.0 (Australia)	8.0	28.5	12.5 (U.S.A.)		
Asbestos	1.2	71.5	12.7 (South Africa)	1.5	65.8	13.6 (South Africa)	nil	nil	nil		
Silver	8.0	19.3	16.1 (Peru)	8.0	19.0	14.8 (Mexico)	9.5	21.0	16.9 (Mexico)		
Gold	2.5	5.4	76.0 (South Africa)	3.0	6.0	79.0 (South Africa)	3.4	7.3	75.2 (South Africa)		
Lead	0.4	13.3	21.6 (U.S.A.)	0.4	14.0	24.0 (U.S.A.)	n.l.	n.l.	n.l.		
Iron Ore	1.2	8.4	14.7 (U.S.A.)	2.4	7.8	15.5 (U.S.A.)	n.l.	n.l.	n.l.		
Gypsum	1.2	13.4	19.0 (U.S.A.)	0.8	13.0	19.0 (U.S.A.)	n.l.	n.l.	n.l.		
Uranium	16.5	19.4	57.4 (U.S.A.)	16.2	19.9	53.5 (U.S.A.)	11.9	16.0	44.5 (U.S.A.)		
Magnesium	nil	2.8	65.8 (U.S.A.)	nil	3.0	61.0 (U.S.A.)	n.l.	4.8	45.6 (U.S.A.)		
Cadmium	9.7	14.4	26.2 (U.S.A.)	6.7	10.4	23.0 (U.S.A.)	n.l.	n.l.	n.l.		
Copper	4.2	13.5	25.9 (U.S.A.)	5.0	13.3	27.0 (U.S.A.)	n.l.	n.l.	n.l.		

Sources: Ontario Mineral Review, 1974, 1973 and 1969, published by Ministry of Natural Resources.

Note: n.l. = not listed.

We have no statistical evidence concerning the potential responsiveness of competing producers to a price increase. Indirectly, however, we can note that new sources of nickel are coming on stream in several parts of the world: Botswana, Philippines, Guatemala, Indonesia, Dominican Republic, Australia, Cuba, and New Caledonia. Most of these involve extraction of nickel from tropical laterite clays, which are readily encountered as surface deposits in tropical countries. The product is less pure, but growing use of an argon-oxygen furnace in stainless steel making has accelerated the reliance on such tropical sources. These factors suggest that foreign sources of nickel are likely to continue to increase their share of world markets, and to be highly responsive to price increases.

We should also distinguish between short-run and long-run responsiveness. In the short run, with the actual stock of investment in nickel exploitation fixed, competing producers would find it difficult to respond to an attempt by Ontario to extract a monopoly price on nickel. However, such a policy would set in motion a significant increase in investment elsewhere. In a few years Ontario's short-run monopoly power would be eroded.¹³ Thus, Ontario's long-run policy must explicitly allow for the fact that the long-run response by competing producers is considerably more than the short run.

We also lack econometric evidence of the responsiveness of nickel users to price changes. Crude materials as a group have relatively low responses to price changes. However, the substitution among crude materials

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The classic case of this is the attempt by Brazil and other South American coffee growers to exercise monopoly power in the post-World War II era. This was soon countered by the rapid development of a West African coffee industry, particularly in the Côte d'Ivoire.

serves to increase substantially the responsiveness of a particular material such as nickel. Further, the growth of nickel use appears to be stable, suggesting no new developments likely to change the use patterns in the foreseeable future.

Although we do not have precise magnitudes, it is possible to compute the optimal monopoly markup for Ontario under various assumed values of Ontario's share, the responsiveness of competing producers, and the responsiveness of users to a price increase. This we have done in Table 11. In the current-to-prospective range of Ontario's share in the world market of 30% to 20%, the optimal monopoly markup is almost certainly less than 10%, and more likely in the range below 5%.

Corresponding to the small percentage optimal monopoly markup is a large percentage reduction in Ontario output. For example, in the neighbourhood of a 5% optimal markup, the level of output in Ontario would be one-third less than the competitive level of output.¹⁴ In other words, Ontario might extract

a small monopoly profit from the exercise of latent monopoly power over nickel, but this could be achieved only by a substantial reduction of nickel mining activity in Ontario.¹⁵

¹⁴ This is based on the assumption that the Ontario elasticity of supply is equal to the absolute value of the demand elasticity facing Ontario.

¹⁵ We should also note an assumption implicit in determining the optimal monopoly markup: the labour and capital that are moved out of nickel mining could move to other equally productive activities. Also, we are abstracting from transitional problems: e.g., unemployment while nickel miners located new jobs.

TABLE 11: Optimal Export Markup Rate on Nickel Under Various Assumed World Demand Elasticities Rest-of-World Supply Elasticities and Shares of Output

Ontario's Share of Market	$\eta_w = -2$			$\eta_w = -5$			$\eta_w = -10$		
	$\epsilon_r = 1$	$\epsilon_r = 5$	$\epsilon_r = 10$	$\epsilon_r = 1$	$\epsilon_r = 5$	$\epsilon_r = 10$	$\epsilon_r = 1$	$\epsilon_r = 5$	$\epsilon_r = 10$
50%	25%	12.5%	7.7%	10%	7.1%	5.3%	5%	4.2%	3.4%
40%	18.2%	8.7%	5.3%	7.7%	5.3%	3.8%	3.9%	3.2%	2.6%
30%	12.5%	5.8%	3.4%	5.6%	3.7%	2.6%	2.9%	2.3%	1.8%
20%	7.7%	3.4%	2.0%	3.6%	2.3%	1.6%	1.9%	1.5%	1.1%

Notes: η_w = world elasticity of demand

ϵ_r = rest-of-world elasticity of supply.

Formula: Let $\eta_o = \frac{\eta_w - \epsilon_r \theta_r}{\theta_o}$

where η_o = elasticity of demand facing Ontario

θ = share of world market

o = Ontario

r = rest of world

Then the optimal markup, k , is

$$k = \left(1 + \frac{1}{\eta_o}\right)^{-1}$$

In view of the concerted efforts by the provincial government to increase economic activity in the nickel mining regions, it is unlikely that the exercise of Ontario's latent monopoly power would prove an attractive policy option.

(5) Rate of Exploitation

The question of whether or not Ontario is using up its mineral resources at the optimal rate is at the heart of much of the public debate over mineral resource policies. Many argue that because we are using up a finite stock of minerals whose future value is unknown, we should conserve that stock and deplete it (if we are going to deplete it at all) at a much slower rate. On the other side of the argument, there are some who contend that the opportunity to sell our resources should be seized now, and little of our stock should be held in reserve for the future. Any attempt to sort out these arguments requires agreement on the objectives to be satisfied. If we employ the economic objective earlier stated, then the resolution of the debate is relatively easy. It is important to recognize, however, that other objectives would yield different resolutions to the debate.

To see the fundamental economic issue it is important to recognize that there is both a flow of ore output and a stock of ore deposits. The relevant price for both is the net price of the ore in the ground before extraction.

Using the net price as the basis for valuation, we can see that the rate of mineral exploitation is socially optimal from an economic standpoint when the net price of a mineral resource used today is equal to the present discounted

net price of a unit used at any future date.¹⁶ Thus, for example, if the net price of a unit used this year is less than the present discounted net price of a unit used next year, it is currently underpriced. Less should be used this year because the marginal use this year will be more valuable next year. And, in the opposite case where the net price of a unit extracted this year is more than the present discounted net price of a unit used next year, too much is being retained for future use.

Under what conditions will this optimal condition prevail? If the following three conditions hold, we can expect the optimal state to hold:

- (a) The market for stocks and flows of mineral resources is competitive.
- (b) The right to a stock of mineral resource is not subject to arbitrary appropriation: i.e., tenure is certain.
- (c) The private discount rate used in present value calculations equals the social discount rate.

In the absence of these conditions, a case for intervention in the market to affect the rate of exploitation can be made.¹⁷ Let us examine each.

16. For a lucid discussion of these issues see Scott (1973) and Solow (1974).

17 Note that there is nothing in these conditions concerning the allocation of the proceeds of sales from the stock of ore deposits. The choice between investment and consumption of the proceeds is the same as the choice between investment and consumption of any other income source, and is totally irrelevant to the issue at hand.

First, consider the market for minerals. The dimensions of the market include: the flow of mineral extractions, and the stock of mineral deposits. A monopoly in either can create a departure from the optimal state. Hence, we need to determine the extent of any monopoly elements in each dimension.¹⁸

Before taking up the matter of the possible existence of monopoly elements, we should note that the effect of monopoly on the rate of exploitation is not certain. The presumption is that a monopoly would result in a rate of use of the monopolized mineral that is less than optimal: i.e., a monopolist is likely to be a conservationist. However, a theoretical possibility exists that a monopolist will use up a mineral deposit faster than is optimal. This arises because the monopolist considers marginal costs and revenues, while the long-run competitive market solution involves average costs and revenues, and the relationship between the average and marginal equilibrium solutions may not be proportional in all relevant situations (Weinstein and Zeckhouser, 1975).

Despite this theoretical possibility, it would be fair to accept as a general presumption that a monopoly would result in an optimal or slower than optimal rate of exhaustion of mineral deposits. We should, therefore, examine

¹⁸

Nevertheless, should there be a monopoly in the flow of extraction, but competitive conditions in the market for the stock of deposits, it would be possible for the monopoly to be broken unless there are effective barriers to entry into the monopolized stage. For example, if a monopolist controls all current extraction activity of a particular mineral, but the deposits are widely held, the monopoly position can be eroded unless there is some effective barrier to entry preventing owners of deposits from engaging in extraction.

whether or not there exist significant noncompetitive forces at work in
Ontario.¹⁹

The flows of extraction and sales activities of most important Ontario minerals are subject to the competitive pressures of world markets. Consequently, there is little opportunity for effective monopolization on the part of Ontario producers. The exception to this general statement arises in the case of nickel where one world-wide company operating in Ontario--INCO--controls about 44% of consumption in the non-communist world (Gauvin, 1974). As a result, INCO

may be exercising its monopoly power on the world markets. INCO's Ontario operations, in turn, may be curtailed to a level that is less than the competitive rate of exploitation. The market for stocks (deposits) of minerals is more difficult to evaluate. There is no reliable set of estimates of ownership of world-wide reserves of major types of ore. Consequently, it is impossible to say with certainty that there is no monopoly power in the holding of reserves. However, we do know that virtually all of the minerals mined in Ontario are found extensively in many different parts of the world. Hence, it is highly unlikely that Ontario policies can either create or break a potential global monopoly on deposits of a particular mineral.

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We should emphasize that this issue is distinct from the issue of exercising Ontario's monopoly power vis-à-vis the rest of the world (discussed in the previous subsection). In the current case the monopoly behavior creates no social gain, but rather a social cost to Ontario, due to the excessively conservative rate of exploitation, whereas in the terms-of-trade issue, Ontario gains at the expense of the rest of the world.

To sum up, there appears to be a potential monopoly influence only in the flow of nickel extraction. The effect of this influence on the rate of exploitation is not certain.

Turn now to the second matter, the certainty of tenure. If there is some possibility that existing owners will be subjected to arbitrary termination of tenure without market value compensation, the uncertainty would induce current holders of mineral rights to speed up their rate of exploitation--resulting in a faster than optimal use rate--to get rid of the stock before the expected confiscation.

There are several ways in which uncertainty of tenure may arise. These include the following possibilities: (a) direct government take-over at less than fair market value; (b) adverse regulations and laws such as repatriation of ownership at less than fair market value; (c) excessive rates of taxation.

To the extent that existing holders of mineral rights are nervous about their status on grounds such as these, they are likely to speed up the drawing down of their stocks of mineral reserves.

To date, there does not seem to be substantial cause for concern by existing holders of Ontario mineral rights over their tenure. Nevertheless, in formulating appropriate policies to deal with other quite legitimate policy objectives it is important that this aspect of optimal mineral policy formulation be taken into account. Policy proposals that are put forward without due attention to this issue can seriously upset the delicate balance between the allocation to current use or to conservation for future use.²⁰

²⁰

See, for example, my discussion of the report by the Ontario Legislature's Select Committee on Economic and Cultural Nationalism contained in Appendix below.

Third, we need to address the issue of whether or not decision-makers, in determining how fast to use mineral resources, are using the appropriate discount rate. The issue here is important. If decision-makers are consistently using too low a discount rate assessing the present value of future uses of minerals, too much of mineral stocks would be retained for future use. This arises simply because not enough weight is placed on the cost of waiting for the future. If, on the other hand, the relevant discount rate is too high, owners of the mineral stock undervalue the future use, and deplete the stock faster than the optimal rate.

Are the owners of the mineral stocks employing the correct discount rate? The answer is probably yes for most private companies. Typically they employ a rate of interest in their decision-making that closely approximates the long-run before-tax rate of return in the economy as a whole. A possible exception might be that they are subject to credit rationing, with the result that their cost of capital would be higher. This would mean that they are using too high a discount rate. Government enterprises, on the other hand, because they do not have to pay corporation taxes, typically use a rate of return that approaches the after-tax rate of return of the private sector. Government ownership of the mineral resources would thus use too low a discount rate. Neither of these problems exists in significant proportions in Ontario. The private companies are typically big enough that they are not subjected to credit rationing, and the government enterprise is not a form of organization currently used in the Ontario mineral sector.

Overall, then, of the factors affecting the rate of exploitation of Ontario's mineral wealth, only the possible monopoly influences appear to bias the rate, and even there the direction of the bias is by no means certain.

(6) Income Distribution

Underlying much of the debate over mineral resource policies is an argument over the initial distribution of income generated in the minerals sector. However, the format of the debate is usually in terms of specific policy choices such as whether or not to tax "rents" accruing to owners of mineral rights. The matter of a general size redistribution or a general functional redistribution is seldom the issue at hand. Those are the issues debated in connection with the overall tax and payment system the government employs. Instead, the fundamental issue is whether or not the distribution of income from our mineral wealth is equitable.

There are two distinct themes that have been pursued in this debate. One concerns the price to be charged different classes of customers for the use of minerals. The other is the matter of who gets the rents that arise from the process of discovery, extraction, and sale of minerals.

The first theme of income redistribution, revolves around proposals for a two price system for minerals. Some users would be charged a lower price than others on the grounds that they are more "deserving." The basic point to make here is well known: if the objective is income redistribution, then on efficiency grounds, a generalized redistribution of purchasing power is preferable to a price distortion such as a two price system. A price distortion will create a production loss, while an income transfer involves no such loss. In general, then, there is no basic case for policy intervention in the minerals sector on such income redistribution grounds. However, the argument to this point has been conducted in first-best terms, implicitly assuming that all policy options are open. When this is not the case, we may be forced into consideration of second-best options, often trading off the efficiency losses against equity gains.

The second theme of income redistribution arises from the existence of economic rents in the process of exploiting mineral deposits. A long-established theme in economic literature is that rents due to the bounty of nature are a surplus over and above the economic costs of obtaining that bounty. Since the rents are socially created, the rights to those rents should accrue to society. Further, appropriate taxation of such "unearned" rents has no adverse effects. A lump-sum tax equal to the total pure rent has no effect on the price of the product or on the level of output. No distortions arise, and total income is unaffected. Taxation of rents in no way violates the conditions for maximum provincial income set down earlier. There is simply an income transfer from some members of society to others. Furthermore, if a rent recipient is a foreigner, lump-sum taxation of his entire rent does not affect his decisions regarding investment here. The tax revenue is all gain to Ontario.

To sum up, the case for policy intervention does not appear to be justified on the basis of the allegedly riskier nature of mineral exploitation, on the basis of substantial foreign investment in the sector, or on the basis of suboptimal rates of exploitation. There may be second best arguments that would justify processing requirements. Ontario's potential monopoly profit from nickel appears very small. And, there may be grounds for redistributing rents generated by mineral exploitation. To what extent do Ontario's current policies correspond to these bases of policy intervention? The answers involve an evaluation of existing Ontario policies--the subject we take up next.

III. Policy Evaluation

We have now established, in general terms, the situations that might justify policy intervention. The task remaining is to examine how a great variety of actual and potential policies impinge on the sector, and to evaluate their effects in the light of both the case for policy intervention and their efficiency in achieving other more limited policy objectives.

1. Existing Policies

Provincial policies toward the minerals sector are formulated in two major areas: mining rights and mining taxation. Each merits an evaluation. As we examine each one separately, however, we should keep in mind the fact that mineral rights policies and taxation policies can be used as substitutes for each other. One could envision a continuum of policy options ranging from an option of full private ownership of all mineral rights combined with a 100% tax on mineral rents, to an option of competitive bidding for mineral leases and no tax on mineral rents. As we shall see, Ontario's mix lies somewhere between.

(a) Mineral Rights²¹

Since the first decade of the twentieth century, Ontario has allowed mineral rights to be privately acquired. It is important for our policy analysis that we understand the process whereby mineral rights are acquired and retained by private interests, and under what conditions the rights revert to the Crown.

21. This portion draws on Ontario (1970) and Ontario (1974c) and the helpful responses to my questions of Mr. J.R. McGinn, Director, Lands Administration Branch, Ministry of Natural Resources.

There are two principal means open to a private individual or company seeking to acquire mineral rights from the Crown in Ontario. First, there is the traditional process of a licenced prospector staking claims in 40 acre units. Second, there is provision for "technical prospecting" by geophysical means.

The traditional method is still very active. In recent years about 20,000 claims have been staked annually. (See Table 12). Note that this does not mean some 20,000 different mineral deposits were staked. Rather, the claims are staked in 40 acre units, and however many units required to cover the desired exploration area are staked.

The purpose of staking a claim is to permit the holder to carry out assessment work with the security that if he finds a deposit of economic value, he will have rights to that deposit.²²

To obtain a lease for the mineral rights, there must be 200 man days of assessment work (or certain equivalents) carried out per 40 acre claim. A lease is for 21 years.²³ The lease can cover the mining rights only, or both mining and surface rights.²⁴

²² Ore deposits can be delineated reasonably accurately. No common property resource problems arise such as when pools of petroleum are discovered.

²³ It should be noted in passing that under previous legislation leases were granted of 10 years duration with automatic renewal. However, the current Act provides for conversion of these leases to the standard 21 year lease. Current lease rental charges are substantially in favor of the 21 year lease, so most of the 10 year perpetual leases are converting.

²⁴ Surface rights may be obtained also for adjacent lands necessary for waste disposal.

Table 12: ONTARIO PROSPECTING ACTIVITIES, 1972-1974

1. <u>Claims</u> (number)	<u>1972</u>	<u>1973</u>	<u>1974</u>
a. Claims Recorded	19,267	18,170	22,097
b. Claim Cancellations	37,753	30,164	18,285
c. Total Claims in Good Standing (end of year)	57,198	45,116	47,795
2. <u>Prospecting</u> (number)			
a. New Prospectors Licences	1,239	1,287	1,252
b. Renewed Prospectors Licences	2,955	2,601	2,518
3. Assessment Work (days)	857,940	598,337	823,904

Source: Ontario Mineral Review, 1973, 1974.

Recent activity in the granting of leases is set out in Table 13.

Note that there are about one hundred leases granted per year. (There are about 6,000 leases outstanding at present.)

A lease holder is able to transfer his rights to another party with the consent of the Ministry. As long as the request to transfer rights is for legitimate mining activities the Ministry's consent is normally granted. About 100 such transfers are made per year. Data on the value of these transactions are not collected.

A 21 year lease is renewable for further terms of 21 years. However, the rental is at a higher rate. (See Table 14). Further, the Ministry must consent and may set new conditions. These provisions are designed to ensure that inactive claims revert to the Crown, and that the intended uses of the leased rights are not abused. It is unlikely that these features will lead to uncertainty of tenure as long as a parallel provision remains. A lease holder, after one year of production, has the option to convert the lease to a fee simple patent.

The current purchase price of a fee simple patent is \$10.00/acre for both mining and surface rights, and \$5.00/acre for mining rights only. In addition, the owner (but not a leasor) of mineral rights has to pay an annual acreage tax of \$0.50 per acre. Comparing the charges for a patent vs. the charges for the initial lease, the present value of the charges for a patent (at a 10% discount rate) are more than 4 times greater than the present value of the charges for the initial 21 year lease. Consequently, very few patents are applied for. From the introduction of this provision in the Act in 1964 to the end of 1974, only three patents for a total of 124 acres have been taken out, and those in 1974. Meanwhile, acreage tax forfeitures to the Crown have

Table 13. ONTARIO MINING LANDS ACQUISITION, 1973, 1974

Method	1973		1974	
	Number	Acres	Number	Acres
Leases				
New	106	31,524	80	23,721
Renewals and Conversions	123	19,740	26	1,571
Surface Rights	2	655	4	820
Patents	0	0	3	124
Lic. of Occupation	2	2,785	2	400,850

Source: Ministry of Natural Resources, Statistics 1974.

Table 14: ANNUAL CHARGES FOR MINERAL LEASES, ONTARIO

Lease - Annual Rental	First 21 years		Subsequent Renewals for 21 years
	1st year	Subsequent years	All years
Mineral and Surface Rights	\$1/acre	\$0.25/acre	\$1/acre
Mineral Rights only	\$1/acre	\$0.10/acre	\$0.50/acre

Source: Mining Act, Sec. 104, 105.

run at annual rates of over 30,000 acres in recent years (Ontario, 1974d).

There are, however, substantial portions of the provincial mineral rights held in fee simple that are not subject to the acreage tax: some 1.5 million acres are subject to the acreage tax out of a total of 28.8 million acres of alienated land. (Ontario, 1974c). The result is that individuals and companies engaged in exploration activities are unlikely to explore on land whose mineral rights are held by others, while the holders of the mineral rights are able to retain the rights at no cost to themselves until mining activity is initiated on the land, at which time the land is subject to the acreage tax.

This anomalous situation has arisen from past land-granting policies under a variety of Acts. It can be remedied readily by extending the acreage tax to all alienated land.²⁵ Those lands with little or no expected mineral deposits would revert to the Crown and those lands containing expected mineral deposits would be retained by the current holders. The latter, however, would be subject to the same acreage tax as other fee simple holders of mineral rights.

²⁵ This has, in fact, been recommended in ibid. They also recommend a simple transitional provision of allowing 3 years for reversion of mineral rights without incurring a tax liability.

The other major route to acquisition of mineral rights on Crown lands is via "technical prospecting" in a pre-negotiated area. This method is designed to permit exploration in remote areas where traditional methods of prospecting would not be appropriate. An exploratory licence, valid for 3 years, grants exclusive exploration rights in an area up to 100 square miles. There is a fee of \$1,000 annually plus a performance deposit of \$25,000 and a minimum work requirement of the greater of \$1/acre and \$15,000 annually. This method, clearly, is not designed for the single prospector.

If a deposit of economic significance is found from such an exploratory licence, the licensee is eligible to lease the mineral rights on a block of up to 10% of the exploration area at a negotiated annual fee of between \$0.50 and \$5.00 per acre. The lease may be renewed for terms of 10 years at renegotiated rentals.

In addition to the two basic methods of staking claims and technical prospecting, the Ministry has authority to "issue a licence of occupation, lease or patent of any mining lands or mining rights on such terms and conditions as he considers expedient." (Ontario, 1970, Sec. 646(2)). This is the usual catch-all clause. It has been very rarely, and only to deal with unusual situations not covered by the standard prospecting practices. For example, it was used to authorize the tendering of claims on a lake bed known to contain a mineral formation.

Overall, Ontario's mineral rights policies seem well designed to facilitate the orderly and systematic exploration and development of the province's mineral resources in the latter half of the twentieth century.

In general, those who expend the funds to find mineral resources will receive the rights to them, and those who do not will not receive windfall gains of mineral rights they did not earn. The one significant exception to this favorable conclusion is the large number of holders of mineral rights who are not subject to the acreage tax.

Further, those who do acquire mineral rights are granted those rights in such a way that they are unlikely to be concerned over their legal security of tenure.

The fees associated with the granting of mineral rights are small. They are in the nature of a user tax for the services of the Ministry.²⁶

The fees are not designed to capture for the province even a portion of the value of the mineral resources. That task is left to the Mining Profits Tax.

(b) Tax Policies

The other major policy instrument employed by the Provincial government is the Mining Profits Tax. In addition, the provincial and the federal corporate income taxes may contain certain special provisions that affect the provincial mining sector.

Let us begin with the Mining Profits Tax. Its recent yields are tabulated in Table 15. The Provincial Treasurer introduced a number of changes in his April 1974 budget that substantially increased the yield.

The tax is levied on profits from the mining stage. It is designed to capture for the province at large a payment for the raw natural resource at the pit-head of the mine.

²⁶ The differential structure of the charges is designed primarily to encourage the use of 21 year leases, and is not related to the economic value of different forms of ownership of mineral rights.

Table 15: ONTARIO MINING PROFITS TAX COLLECTIONS
(Fiscal Year 1971-72 to 1976-77 (\$ million))

Fiscal Year (ends March 31)	Collections
1971-72	13
1972-73	16
1973-74	47
1974-75	153
1975-76*	62
1976-77**	100

Note: *interim

**estimate

Source: Ontario, Public Accounts; and Ontario, Budget

Several features of the tax are worth noting. It is important to keep in mind that the mining profits tax is based on profits, not units of ore extracted. As such it is far easier to administer and less subject to evasion than a levy on tons of ore extracted. In contrast also with a per unit of ore tax, it does not bias the grade of ore extracted toward higher grade ores ("high grading") because it does not affect the relative costs of extracting the equivalent amount of metal from high grade vs. low grade ore. Also, because the tax is on profits, it does capture some of the pure rent accruing from the mineral extraction process. Finally, the tax contains no inherent intertemporal biases, either speeding up or slowing down the rate of depletion of our stock of minerals.

Beyond these general points, two important features of the tax are worth exploring in more detail. The first concerns the extent to which the tax impinges solely on rent, and the second concerns the processing incentives embodied in the tax.

First, then, is the question of how effective the Ontario mining profits tax is in isolating rent. This is a difficult practical problem. From the days of Henry George, (1871,1905), there have been proposals designed to tax rents. In the modern era we have witnessed some ingenious proposals that aim at taxing rents. One, for example, is a graduated net profits tax on mineral extraction.²⁷ In a similar vein, but allowing for full recovery of

27. See Lockner (1962). I am indebted to M. Bucovetsky for this reference.

capital costs, is a proposal contained in a recent paper by R. Garnaut and A. Clunies-Ross (1975).

Closer to home is the proposal by the Smith Committee on taxation in Ontario (Ontario, 1967). The Report proposed a uniform tax rate on profits after allowing for all expenses, including an allowance for capital employed in mineral extraction (but excluding the rental or purchase of mineral rights).

The first issue that confronts the policy-maker is how to arrive at the appropriate base for taxation in a way that actually separates out the true rent and at the same time is not subject to serious evasion. This is by no means a trivial question. It lies at the heart of the recent controversy between the federal and provincial governments on the issue of deductibility of provincial "royalties" in the federal corporate income tax. The former is designed to tax the rents, while the latter is to tax the return on capital. When one impinges on the other, there is no clear basis for drawing the line between the two.

The difficulty in determining the appropriate rent to be taxed can be seen if we define rent as the long-run difference between the price and the economic cost of extracting the minerals, including the costs of exploration and discovery of deposits. In general, we would expect some mineral extraction activity at the margin yielding no rent, while the remaining activities may yield some rent. Only if it is possible to distinguish between these is it possible to tax away the rent without also introducing a production distortion.

Three questions arise. First, how effective is the Ontario mining profits tax in isolating rent? Second, how much of the pure rent does the tax capture? Third, does the tax affect the level of activity in the sector?

To answer these questions, we need to know something about the definition of expenses under the tax. Most major expenses are allowable under the tax as recently revised. (Ontario, 1972). These include (1) all working expenses; (2) depreciation on plant and equipment; (3) exploration and development expenses (except for acquisition of mineral rights). However, the Mining Tax Act does not make any allowance for a return on capital invested.²⁸ As a result, to answer the first question, the tax base includes both rent and return on capital.

A number of points follow from this. The tax rate is less than 100% on a base that is more than 100% of rent. Hence, to answer the second question, for some mines (the marginal ones) the tax captures more than the rent because the base is largely non-rent, and some mines (the high-rent ones) pay only a fraction of the rent in the mining tax. Between the high rent and the marginal mines, the answer is indeterminate: there are some mines paying more than the equivalent of their economic rent, some less, and probably some the approximate equivalent.

Further, to answer the third question, because the tax falls on more than just rent, the level of activity in the mineral sector is affected by the extent of the tax. However, precise calculation of the effect of the tax on output or employment is complicated by the fact that the effect of the tax differs between deposits, depending on the ratio of rents to total profits (as defined by the tax). It is also complicated by the progressive structure

²⁸ "No allowance or deduction shall be made in respect of...capital invested, or interest or dividend upon capital or stock or investment..."
The Mining Tax Act, 3(4).

of the tax schedule, and between-company differences in the degree of further processing. In the absence of detailed data on each of these elements it is virtually impossible to compute the effect of the tax on the level of activity in the sector.²⁹

All of this suggests that it would be worthwhile to attempt to design the mining tax so that the base would be more nearly equivalent to the pure economic rent. I have argued elsewhere that this, in fact, is possible (Leith, 1976).

The major change necessary would be to permit an allowance for a return on capital invested. This could be accomplished by permitting, as suggested by the Smith Committee, an "investment allowance" as an expense in computing taxable profits. (Investment in mining rights would have to be excluded.) The allowance should reflect the normal return on capital invested in similar circumstances, including risk. Although any concrete measure would almost certainly have an arbitrary element involved in it, as a practical matter if an "investment allowance" were deducted as an expense, the base for the mining profits tax would be an approximate measure of the rents generated in the mining activity.

29. A recent econometric study (Anders, Gramm and Maurice, 1975) found the tax rate not significantly different from zero in explaining investment in Ontario mining.

A narrowing of the tax base would normally be accompanied by an increase in the tax rate. The tax rate, however, should be set at less than 100% of rent as defined in the tax law. A 100% tax would effectively turn the minerals sector into a regulated industry with all the well-known problems of distorted investment bases.

Even if the tax could be designed so that it would fall on rent only, an important income distribution issue remains. The distribution of the tax burden among companies would be changed. Companies with a high ratio of rents to total profits would face a relatively heavier tax burden than companies with a low ratio of rents to profits.

Whether or not the absolute tax burden on a company would also change depends on the tax rate that is set. If, for example, the rate were set to maintain the same level of total tax collections, a pure rent tax would mean an increase in the absolute tax burden of at least one high rent company. Shareholders of companies facing an absolute increase in tax burden would be subjected to a capital loss.

The willingness of a given jurisdiction to impose such a capital loss on the shareholders of mining companies depends on the residence of the shareholders. Substantial foreign ownership, for example, greatly reduces the significance of the total capital loss to domestic residents, and might well make a stiff pure rent tax more attractive. This is the situation Ontario finds itself in. As we noted earlier, foreign controlled firms account for some 70% to 80% of Ontario mining activity (depending on the measure of activity used). If the high rent companies happen also to be foreign controlled, the capital loss arising from the introduction of a pure-rent tax would be borne by foreign controlled firms. It is conceivable, however, that the opposite situation prevails. To evaluate the situation empirically would require access to the mining tax returns of individual companies.

The second aspect of existing Ontario policies meriting an examination concerns the promotion of further processing locally. In general, the Ontario Mining Act imposes a blanket condition on holders of mining rights that "all ores or minerals raised or removed therefrom shall be treated and refined in Canada so as to yield refined metal in other products suitable for direct use in the country without further treatment. (Ontario, 1970, Ch. 274, para. 113)."

It is, however, left to the Minister to determine the stage of refinement which meets this condition, and to the Lieutenant Governor in Council to exempt holders of mining rights from this requirement.

In addition, and of far greater importance, the Mining Tax Act, 1972 has two major elements which act to promote local processing beyond the primary stage. The mining tax is levied on profits from the activity of mining. Thus the focus is on mined ore at the pithead, and associated activities.

There is a provision in the Mining Tax Act which permits deduction of certain developmental expenses, "provided that the ore taken from the mine is beneficiated, at least to the smelter stage, in Canada. (Ontario, 1970, para. 3, (n) (ii)).".

By far the most important instrument bearing on local processing is not even formally mentioned in the Mining Tax Act. This instrument is the "processing allowance" system. It contains significant incentives in two directions. First, it encourages further processing beyond the ore-at-the-pithead stage, and does so progressively by stages of production. The incentive for smelting is less than for refining, which is less than for processing beyond the refining stage. Second, it now encourages processing in Northern Ontario vis-à-vis the rest of Canada, and in Canada relative to the rest of the world.

The processing allowance itself is not inherently discriminatory in either of the ways just mentioned. It is an administrative measure made necessary by the fact that the mining profits tax is levied on profits at the pithead, while sales are normally made at a later stage of processing. Thus, to arrive at a measure of profits at the pithead, the tax assessor is able to evaluate revenue from eventual sale of, say, the smelted or refined metal, and is able to deduct normal expenses up to the point of sale. In determining "normal expenses" there has to be some allowance for net profit at stages subsequent to the pit-head stage. This allowance is called the "processing allowance." If this allowance were simply an allowance for normal profits at a reasonable rate, and did not discriminate between stages or between locations, it would not have any broad policy implications. The allowance does, in fact, discriminate in both these ways.

Discrimination by stage of processing is achieved by giving a progressively higher allowance for more advanced stages. Discrimination by location is achieved by giving a higher allowance for processing in Northern Ontario than in the rest of Canada, and no allowance for processing outside Canada. The processing allowance rates are shown in Table 16.

Table 16 : PROCESSING ALLOWANCES IN COMPUTING ONTARIO MINING PROFITS TAX
(Percent of value of processing assets)

Stage	Proposed June 20, 1974			Previous	
	<u>Northern Ontario</u>	<u>Rest of Canada</u>	<u>Outside Canada</u>	<u>Canada</u>	<u>Outside Canada</u>
Concentrating	8%	8%	0	8%	8%
Smelting	16%	16%	0	16%	8%
Refining	30%	20%	0	20%	8%
Further Processing	35%	0	0	-	-

Notes:

- a) The new system defines processing assets "as constructed" thus permitting immediate write-off. The previous system defined processing assets as those "in use."
- b) The new system was formally adopted in February, 1975, and made retroactive to April 19, 1974.
- c) In December, 1975, the Minister of Natural Resources announced that for a five year period (beginning from the effective initial date of the regulation) foreign processing costs would be allowed.

Source: Statement to the Legislature by Treasurer of Ontario, June 20, 1974.

The incentive (or disincentive) element in these allowances arises from the extent to which they depart from a "normal" allowance for net profits. The "normal" allowance is, apparently, considered to be 8%. This is an amazingly close approximation of average net after tax profit on total assets in Canadian metal mining over the past decade (see Table 17).

Working from a norm of 8%, then, the subsidy element amounts to the excess (deficiency) over 8%. Hence, under the system proposed in June 1974, there is a subsidy amounting to 8% of the value of the given stage's assets (as constructed) to take the ore through the smelting stage and amounting to 22% to take it through the refining stage in Northern Ontario. Processing elsewhere in Canada has the same incentive at the smelting stage, but at the refining stage the incentive is only 12%. There is a penalty of 8% for each stage if the processing takes place outside Canada. Clearly, the intent is to promote processing as far as possible in Northern Ontario.

While the direction and structure of these processing incentives are clear, it is by no means a simple task to evaluate the precise magnitudes of the differential incentives. The difficulty arises in not having detailed cost data by stage of processing.

To obtain a quantitative image of the impact of the processing allowances, we have computed hypothetical mining profits taxes for each of the categories under the previous and new systems, with processing assumed to be completed in turn through each of the stages of concentrating, smelting, and refining. To ensure that there would be no effect attributable to differential size of assets between stages, we made

Table 17 : NET PROFIT RATES ON TOTAL ASSETS, CANADA, SELECTED INDUSTRIES,
1962-73 (percent)

Year	All Industries	Total Mining	Metal Mining	Mineral Fuels	Other Mining	Total Manufacturing	Transportation
1962	4.8	6.6	8.6	3.2	6.6	5.2	2.5
1963	5.2	6.9	8.7	3.9	6.9	5.8	3.2
1964	5.9	8.8	11.9	4.4	6.8	6.3	4.1
1965	6.2	8.9	11.3	5.3	3.2	6.2	4.9
1966	5.7	7.6	9.7	4.6	7.2	5.9	4.1
1967	5.0	8.0	10.2	5.3	6.5	4.7	3.4
1968	5.1	7.6	9.5	5.4	6.5	5.1	3.4
1969	4.9	6.5	8.7	4.3	4.9	5.3	3.2
1970	4.2	6.9	9.4	4.6	4.2	3.8	3.2
1971	4.6	5.5	5.3	6.0	4.2	4.9	3.5
1972	5.1	4.5	3.0	6.5	4.4	5.6	4.1
1973	6.7	8.9	8.7	8.7	10.5	7.4	4.4
Mean	5.3	7.2	8.7	5.2	6.0	5.5	3.7
St.Dev.	.71	1.37	2.44	1.43	1.95	.91	.66

Source: D.B.S., Industrial Corporation Financial Statistics.

the illustrative assumption that \$10,000,000 of assets were employed at each stage of mining, concentrating, smelting, and refining. We also assumed that the before tax rate of return on assets at each stage is identical at 14%. (This is about the average base profit rate in Canadian metal mining-- see Table 9.)

The results of our hypothetical calculations are contained in Table 18. Consider the system employed up to 1974. The location of the concentrating stage, which in any case is heavily influenced by transportation costs, was unaffected by the processing allowances. The smelting stage would reduce the hypothetical firm's tax payable by \$119,000, by locating in Canada. If the hypothetical company added a refining stage, it would reduce its tax payable by \$300,000.

Under the new system, if processing were located outside Canada, the tax payable would be substantially increased, and progressively so at each of the concentrating, smelting, and refining stages. The tax payable for processing in Canada but outside Northern Ontario would be increased very slightly. The tax payable would be reduced to practically zero for processing through the refining stage in Northern Ontario.

It is important to stress that these are calculations based on hypothetical asset and profit rate assumptions. They do, however, serve to illustrate the differential structure of the Mining Profits Tax.

In general, the incentives for processing in Canada and in Northern Ontario are substantial under the new system. However, it should be noted that the potential total processing incentive is strictly limited. This arises from the fact that the incentives are in the form of a reduction of profits taxes payable. This has two important implications. First, the firm must be making profits to obtain any benefit from the incentives, and

Table 18 : HYPOTHETICAL MINING PROFITS TAX CALCULATIONS, PREVIOUS AND NEW (1974) SYSTEMS (\$, 000)

	Stage Through Which Processing Completed		
	Concentrating	Smelting	Refining
Previous-Outside Canada			
(a) Mining Profits Subj.to Tax	\$2,000	\$2,600	\$3,200
(b) Tax Payable	\$ 293	\$ 382	\$ 472
(c) Effective Tax Rate	10.4%	9.1%	8.4%
Previous-In Canada			
(a) Mining Profits Subj.to Tax	\$2,000	\$1,800	\$1,200
(b) Tax Payable	\$ 293	\$ 263	\$ 172
(c) Effective Tax Rate	10.4%	6.3%	3.1%
New-Outside Canada			
(a) Mining Profits Subj.to Tax	\$2,800	\$4,200	\$5,600
(b) Tax Payable	\$ 495	\$ 775	\$1,055
(c) Effective Tax Rate	17.7%	18.5%	18.8%
New-Rest of Canada			
(a) Mining Profits Subj.to Tax	\$2,000	\$1,800	\$1,200
(b) Tax Payable	\$ 335	\$ 295	\$ 175
(c) Effective Tax Rate	12.0%	7.0%	3.1%
New-Northern Ontario			
(a) Mining Profits Subj.to Tax	\$2,000	\$1,800	\$ 200
(b) Tax Payable	\$ 335	\$295	\$ 15
(c) Effective Tax Rate	12.0%	7.0%	0.3%

Notes:

1. Calculations based on assumptions of: (a) \$10,000,000 assets employed at each stage; (b) before tax profits at each stage amount to 14%.
2. Previous and proposed processing allowances are those contained in Table 16 .
3. Previous tax rate of 15% on all mining profits over \$50,000 and proposed tax rates contained in Table 3 .
4. Effective tax rate is the total tax payable as percent of assumed before tax profits through that stage.
5. Processing allowances applied to assets in use in both previous and proposed systems.
6. For example: (a) Compute the previous tax on profits where processing is done outside Canada through the smelting stage. Assets employed are \$10 million in each of mining, concentrating and smelting. Gross profits on \$30 million assets are \$4.2 million. Processing allowances amount to \$0.8 million on each of the concentrating and the smelting stages, reducing gross profits subject to tax

to \$2.6 million. Deduct tax free allowance of \$50,000 and compute tax of 15 % on the remaining \$2.55 million. Tax payable is \$382,500 which is an effective tax rate of 9.1 % on the \$4.2 million of gross profit.

(b) Compute the new tax on profits where the processing is done in Northern Ontario through the refining stage. Assets employed are \$10 million in each of mining, concentrating, smelting, and refining. Gross profits are \$5.6 million. Processing allowances amount to \$3 million on refining stage, \$1.6 million on smelting stage, and \$0.8 million on concentrating stage, reducing gross profits subject to tax from \$5.6 million to \$0.2 million. Deduct tax free allowance of \$0.1 million and compute 15 % tax on the remaining \$0.1 million of \$15,000. This is an effective tax rate of less than 0.3 % on the \$5.6 million of gross profits.

second, the incentive cannot amount to more than an elimination of the tax payable.

One feature of the new system, which is not illustrated in our hypothetical calculations, relates to the interaction between the new progressive structure of the mining profits tax (Table 3) and the processing allowances. A firm operating on a scale significantly below our hypothetical firm in Table 18 would face lower marginal tax rates, and would not derive a substantial gain from putting up a refinery. A firm much larger than our hypothetical one would face progressively higher tax rates, and would therefore derive much greater benefits from the incentive to locate the refining stage in Northern Ontario. By taking advantage of the incentives the larger firm may well be able to reduce its effective tax rate to a level approaching that of the medium sized firm illustrated in Table 18.

It is also worth noting that the processing allowance is based on capital assets. Hence, there is a potential capital bias in the incentives: the greater the capital per unit of output, the greater the incentive per unit of output (for the same level of profits). The bias, however, is limited by the linking of the incentives with profitability. There is a cost to increasing capital intensity beyond the optimal, which would have to be weighed against the benefit derived. As a result, a priori one would not expect a substantial bias to result from the present scheme.

One further feature of this system of processing incentives is that it does not make subsequent stages less competitive the way some alternative instruments would do. Any instrument that creates its incentive by increasing the product price (e.g., a tariff on competing imports) has the major disadvantage that it discourages downstream production by raising the latter's costs. The processing allowance scheme, however, leaves costs of independent

downstream producers unaffected because nothing is done to alter the world-determined price at which they can buy their inputs. Costs for downstream operations of integrated producers may even appear to be reduced, depending on how the integrated producer values material as it moves from one stage to the next. The system does, however, evidently require a vertically integrated producer to respond to the processing incentives.

Although the primary tax policy instrument bearing on Ontario mining is the provincial mining tax, the provincial and federal corporate income taxes contain certain special provisions for mining companies. The principal provisions of the federal and Ontario corporate income taxes on the mining industry are summarized in Table 19.

There are two major dimensions to the corporate taxes that merit our attention. First, there is the matter of the relationship between the mining tax and the corporate income taxes. In brief, past links between the two are largely eliminated. Ontario has no significant link between the two taxes. The federal "resource allowance" provision recognizes the existence of the provincial taxes, but the size of the resource allowance is unrelated to the size of the provincial taxes.

To the extent that the mining tax and the corporate income taxes are designed to tax different things, this separation of the two is entirely appropriate. However, as we noted earlier, the provincial mining tax bears in part on corporate income. Hence, in the extreme, it is conceivable that a failure to take into account the simultaneous effect of both sets of taxes could generate perverse situations such as marginal tax rates in excess of 100%. Beyond noting the possibility, we do not believe that this is a serious problem in itself.

Table 19: Summary of Federal and Ontario Corporation Income Tax Provisions Affecting Mining Industry, July 1, 1976

Item	Federal	Ontario
1. Rates	Same as generally applied to corporations: 46%, less 10% points abated to provinces.	Same as generally applied to corporations: 12%.
2. Mining Taxes Not Deductible	Payments of royalties and mining taxes payable to government bodies <u>not</u> deductible as an expense.	Mining taxes and royalties payable to any jurisdiction <u>not</u> deductible as an expense.
3. Resource Allowance	In recognition of provincial resource levies taxable income is reduced by 25% of "resource production profits," (defined as sales revenues less operating costs and capital cost allowances, but <u>not</u> deducting interest on debt, exploration, development, or depletion expenses).	None
4. Depletion Allowance	An "earned" depletion allowance of \$1.00 for each \$3.00 of certain expenditures (exploration and development; for new mines--for machinery and equipment, and production buildings to prime metal stage), up to a maximum of 25% of net profit.	Allowance of 33 1/3% of the amount of production profits.
5. Exploration Expenses	Canadian exploration expenses 100% deductible. (May 1976 budget suspended to July 1, 1979 lower rate for non-principal business corporations: 30% of balance of cumulative Canadian exploration expenses.)	Ontario exploration expenses 100% deductible. Rest of Canada exploration expenses to greater of mining income or 20% of expenses against any income.
6. Development Expenses	Canadian development expenses deductible at a rate of 30% of the balance of cumulative Canadian development expenses.	Same as exploration expenses.
7. Capital Cost Allowance	Expenditures for new mines on machinery and equipment and structures up to the prime metal stage may be depreciated at the rate of 30% annually until production begins, after which the remaining balance may be charged 100% against the new mine's income. For major expansions (an increase in capacity exceeding 25%) a similar provision applies to a more restricted list of assets that excludes several types of general overhead types of buildings, roads, etc. (The allowable list of assets is identical with the list applicable for the depletion allowance.)	Parallels federal provision
Sources	C.C.H. Canadian Ltd., <u>Canadian Tax Reports</u> , No. 148 (Dec. 3, 1974) and No. 177 (June 23, 1975). Canadian Tax Foundation, <u>The National Finances, 1974-75, C.T.F., Toronto, 1975.</u>	Ontario Treasurer, <u>Budget Statements, 1971 through 1975; and Ontario, The Corporations Tax Act, 1972 as amended to September, 1975.</u>

Second, the corporation taxes contain certain special provisions that are unique to the minerals sector. On balance these provide for some preferential treatment. However, compared with the situation in the 1960's, the current corporate tax treatment of the sector is far less favorable.³⁰

Many of the earlier provisions were abandoned in the federal tax reform legislation, the provincial responses, and subsequent adjustments by both jurisdictions. In fact, adjustments continue to be made: the May 1976 federal budget introduced a change in the treatment of exploration expenses.

The federal corporation income tax contains two types of concessionary provisions.

The first is the depletion allowance. This effectively reduces the tax liability by 25% if the necessary expenditures have been incurred. Thus, the amount of the concession depends on profitable activity to be of any value, and then is only at a 25% rate. Further, the eligible expenditures all relate to new activities: depletion allowances will be a concession only if the company continues to engage in exploration, development, and/or bringing into production of new mines.

The second type of concession consists of the various provisions for fast write-off of certain expenditures. In general, any capital expenditure should be charged as an expense while it is being used up in the production process. A tax provision that permits capital costs to be expended sooner is a concession. Thus, to permit exploration expenses to be charged 100% when they are incurred, and not as the ore so discovered is used up, gives

30. The federal tax situation in the early 1960's is described in Bucovetsky (1966). The provincial situation in the mid 1960's is reviewed by the Smith Committee (Ontario, 1967).

the exploration activity special treatment. Similarly, but not as dramatically, the 30% rate allowed on development expenses is faster than the life of the asset would justify, and thus contains a concessionary element. Note the more favorable treatment of exploration vis-à-vis development expenditures.

Whether or not this may be justified will be taken up shortly.

The capital cost allowance is also an accelerated depreciation feature. Its provisions are obviously designed to encourage mining companies to bring new mines and major expansions into production.

The accelerated depreciation features, as the depletion allowance, are concessions only to the extent that a company engages in new mineral activities. They provide no benefit to a company that is simply extracting ore from an existing mine. The effects of this bias are several. Vertical integration is encouraged. Search for and development of new deposits will be greater than otherwise. This, in turn, depresses the price of mineral deposits, resulting in a depletion of the national stock of resources that is faster than otherwise.

Having established the nature of the concessions embodied in the federal corporate income tax law, we may now ask whether or not the concessions are justified. The arguments for concessionary treatment for the sector were outlined in Part II, and no broad basis for special concessions was found. There are, however, a few matters that relate to the nature of the corporate income tax itself. These are fundamentally arguments that a uniform corporate income tax would create distortions because of different conditions between industries.

The first such inter-industry difference is capital intensity. The corporate income tax falls on capital, and since the minerals sector is more

capital-intensive than other sectors, a uniform tax rate bears more heavily on the minerals sector. The argument has some validity to it, depending on the extent of shifting of the corporate tax burden. However, for it to justify special treatment for the minerals sector alone, the minerals sector alone should be substantially more capital intensive than all other sectors.

This is simply not the case.³¹ Hence, the case for unique special treatment of the minerals sector on this ground does not follow.

The second non-uniformity relates to different equity/debt ratios between industries. A uniform corporate tax on income, after debt charges are deducted, falls more heavily on companies that rely more on equity financing. Does mineral extraction in fact exhibit a higher equity/debt ratio? Again, the answer is no, and again there is no case for special treatment of the sector.³²

Third, a higher variability of income that includes periodic losses, combined with the absence of provision for full loss offsetting against profitable years, means that the same average before tax rate of return between industries gives a lower after tax rate of return to the more variable industry.³³ This argument does have some validity for the minerals sector.

As we noted in Table 9 above, the variance for mining is greater than for manufacturing.

³¹ See, for example, Bucovetsky, (1966, Appendix C). He found the capital output ratio for mineral extraction higher than most industries, but not all, and that of some other sectors much higher.

³² This is also documented by Bucovetsky, (1966). He found no significant difference between mineral extraction and manufacturing.

³³ Some loss offsetting is permitted. A non-capital loss "may be applied to reduce income in the immediately preceding taxation year and in the five subsequent taxation years." (Canada, 1972).

In brief, the special concessions for the minerals sector in the federal corporate income tax may be justified because losses are not fully allowed for. Yet the special concessions have little, if any, direct link with this problem. The depletion allowance can be charged only against net profit, and is thus irrelevant when losses are incurred. The treatment of exploration and development expenses as well as the capital cost allowances are forms of accelerated depreciation allowances, and again bear no direct connection with the problem of loss years.³⁴

A much more appropriate method of dealing with the asymmetry created by loss years would be to allow unlimited offsetting of losses against profitable years.

The provincial corporate income tax generally parallels the federal tax. However, there are a few key differences worth noting. The Ontario provincial tax rate of 12% exceeds the 10% abated by the federal tax, but in the same manner as the federal tax the rate on mining is the same as generally applied to other corporations.

In one area the provincial tax is less generous than the federal: there is no resource allowance in recognition of the provincial mining tax. In two areas the provincial tax is more generous than the federal: the depletion allowance and the development expense deduction. The provincial depletion allowance rate is greater than the federal, on the larger base of production profits rather than net profits. The provincial allowance is not "earned" by making new expenditures. The provincial tax treats exploration and development expenses identically, while the federal law is

³⁴We should note in passing, however, that the more favorable treatment given exploration expenses may be due to the fact that losses are more likely in exploration activities than in development work.

less generous in its treatment of development expenses.

It is impossible to make a general statement of which tax provides the more generous treatment of the mining industry because the particular circumstances of a company will heavily influence the outcome.

What is more important to note, in fact, is that the two taxing authorities are in substantial agreement. Both give the minerals sector favored treatment, and both have some link between the special treatment and the process of finding, developing and bringing into production new (or major expansions of existing) mines. The concessions are unrelated to a legitimate problem in the tax treatment of the sector--the absence of full loss-offsetting. The special concessions should be abandoned and full loss offsetting introduced.

2. Assessment of General Policy Alternatives

In the long-run, all policy instruments are potentially variable. This broadens the selection of the appropriate policy mix, permitting us to consider alternatives that are not now part of the instrument kit in every day use. However, even long-run policy choice cannot ignore the existence of a particular set of instruments that are already in use. Businessmen and employees have adjusted to an existing set of policies. Drastic changes in existing policies, or introduction of new policies that substantially change the status quo, inevitably create a significant adjustment problem. For this reason, while our focus is on the long-run, we must recognize the fact that substantial changes in any direction are not likely to be considered for implementation at any one time. Our analysis, therefore, is set against the background of the status quo. We do not consider a great variety of alternatives that are so far removed from the present arrangement that they are unlikely ever to receive serious consideration as viable alternatives.

A number of options do merit examination simply because they are, in one form or another, being considered for Ontario in the 1970's.³⁵

35. For example, Ontario (1974a) focuses largely on the two policy instruments we now take up.

Two important types of potential policy instruments should be noted:

- (a) public ownership of the minerals sector; and
- (b) restriction of foreign ownership and control in the minerals sector.

Let us look at each.

First, is there a case for treating the mineral sector as a serious candidate for nationalization? Apart from a doctrinaire socialist viewpoint, there seem to be two types of cases made favouring nationalization. One relates to the pooling of very large risks which individual firms cannot bear. Collectively the risk would be acceptable, but individually it would not. Some way of pooling risk is therefore required, and public ownership is suggested as a pooling device.³⁷ The case thus casts public ownership in the role of "risk-pooler of last resort."

The practical issue to be determined in this set of circumstances is whether or not the last resort has been reached. It is not obvious that it has. Typically, experience in Canada has been that whenever a project requires pooling, such pooling usually occurs. A recent example is the consortium involved in arctic oil and gas exploration.

³⁶ Note that we distinguish between policy instruments that change economic actions in some way and statements of objectives or desires on the part of policy-makers which, in the absence of explicit action (i.e., use of an instrument) remain in the realm of desires.

³⁷ Note that the issue is not whether or not the collective risk is too great for the collective entity to undertake.

The other case for nationalization arises from the problem of collecting unexpected windfall gains.³⁸ Current taxes do not capture 100% of windfall gains arising from unexpected price increases. Public ownership, other things equal, would capture unexpected future economic rents.

This argument is not unique to the minerals sector. There are economic rents and quasi-rents accruing throughout the economy, and are only partially captured through taxation of both income and capital gains. The issue, then, is really one of whether or not an attempt should be made to use public ownership to capture all future windfall gains and bear all future capital losses. Such an issue must be discussed in a context far broader than minerals policy. The case for or against public ownership in the mineral sector on these grounds is fundamentally no different than the case for or against public ownership in general.

Second, in the matter of foreign control, there are important differences between the mineral sector and the rest of the economy. The first difference is that international vertical integration is far more common in the mineral industry than most other industries. Thus, if Ontario or even Canada decided to cut loose from the foreign ownership and control that now characterizes the sector there would be serious difficulties in marketing our products in the world. This is not because of some perverse response by the present foreign investors. Rather, it arises because the number of firms at the

³⁸ Existing owners, however, have already capitalized expected future rents into their asset values.

fabricating stage is small and even if there are some non-integrated ones, they are likely to enter into long-term supply contracts to reduce risk in feeding their large-scale fabricating facility.³⁹

Aside from the marketing problem, there is also a potential transitional problem relating to the tenure of the mineral claim holders. If the reduction in foreign investment involves some kind of time limit, there is an incentive for the foreign investors to speed up the rate of extraction to a rate that exceeds the optimal.

Perhaps it is worth noting that the mining sector is not different in one major respect. There seems to be no obvious reason for treating it as a candidate for regulation as, say, a natural monopoly. Despite the occasional fretting by our bureaucrats that the mining companies' board rooms are outside our boundaries and hence less sensitive to moral suasion (and perhaps more sensitive to that of a foreign bureaucrat), there does not seem to be a case for policy implementation by decree rather than incentive.

³⁹ R. E. Caves makes this point in discussing Australian mineral policies.

3. Conclusion

On balance, the set of economic policies currently employed by Ontario towards the mineral extraction sector are not seriously out of line with what an optimal set of economic policies would be, taking into account the multi-faceted case for policy intervention in the sector. There is room for improvement in some of the details of specific policy instruments. Particular attention should be given to the following:

- (a) extension of the acreage tax to the mineral rights on all lands held in fee simple;
- (b) inclusion of an allowance for return on capital in the mining tax; and
- (c) elimination of the remaining special treatment of the minerals sector in the federal and provincial corporate income taxes, and adoption of full loss offsetting privileges.

However, there is no clear basis for radical changes in the current set of economic policies.⁴⁰

⁴⁰ The case for substantial change put forward by the Ontario Select Committee on Economic and Cultural Nationalism in its report on Non-Renewable Natural Resources is not, in our view, convincing. Our reasons are set out in the Appendix.

APPENDIX A: A Review of Some Specific Policy Proposals

Beyond the two general types of instruments discussed in III.2, there are several specific variations on the overall theme that have been put forward by the Ontario Legislature's Select Committee on Economic and Cultural Nationalism (1974a)

Before reviewing some of the specific proposals, we should note one fundamental error in the report which establishes a false premise from which many of the recommendations flow. The error is the use of the wrong data to compare the relative significance of the "non-renewable natural resource" sector, as the report calls mineral extraction, with manufacturing and "renewable natural resources" (agriculture, forestry, and fisheries). The Interim Report relies solely on data reported under the Corporations and Labour Unions Returns Act (CALURA). Information reported under this Act excludes all unincorporated businesses which dominate the "renewable" natural resources sector. Hence, the observation, given prominent play in the early stages of the Interim Report, that "the non-renewable sector is about ten times the size of the renewable sector, (Ontario, 1974a,3)" is wrong. The true relative size of the mining sector we indicated in Part I. There we saw, for example, that value added in Ontario mining is about the same as in Ontario agriculture alone, and about one quarter of Ontario construction industry, and one sixteenth that of Ontario manufacturing (Ontario, 1974a,9)".

The false assumption about the relative sizes of the mining and manufacturing sectors leads to the first recommendation of the Interim Report.

"The Committee recommends that Canadian economic policies be re-oriented such that a greater emphasis be given to the development of the manufacturing sector and that the non-renewable resources sector be de-emphasized. (Ontario, 1974a,8)."

In addition to this first objective of more "balance" between sectors, the Interim Report also sets out the objective of "a strong and visible Canadian controlled presence in the non-renewable natural resources sector." (Ontario, 1974a, 13)."

Given these two objectives, the Interim Report develops a number of recommendations that specific instruments be deployed in particular ways.⁴¹

These recommendations are worth examining in the light of our analytical framework.

As a solution to the problem that Canadian firms, not parts of vertically integrated multinational firms, would not have access to secure foreign markets, the policy is proposed that the Canadian Foreign Investment Review Agency consider as an alternative to direct foreign investment a bargaining of assured supplies for assured markets. A priori there is nothing clearly advantageous or disadvantageous in such bargaining. The balance of advantage all depends on the state of the market and the effectiveness of the bargainers. In a market with excess supplies hanging over it, purchasers are not particularly interested in obtaining assured supplies. In a market unable to satisfy an excess demand, sellers are not particularly interested in obtaining a market access guarantee. Thus, what at one time looks like a good bargain

⁴¹ Several recommendations do not call for specific economic policy actions, but are in fact statements of subsidiary objectives.

for one side, at another time may well appear to be to the advantage of the other side.

The Committee sees a more active role for governments in such bargaining, but offers no reason to believe that government bargainers would strike a better bargain than private bargainers.

Another instrument that might be brought to bear is the Canadian tariff policy. The Committee recommends that Canada bargain for a world tariff structure which removes the current bias against trade in processed goods. To do so, it notes that Canada will have to give up the bias in its own tariff. The clear conflict between this goal and the goal of increased activity in Canada's import-competing manufacturing sector is not noted by the Committee. The Committee is in favour of encouraging further processing in Canada. Evidently it was not entirely aware of the incentives for further processing embodied in the processing allowances, and recommends:

"That consideration be given to a system of 'earning' reductions in tax according to a sliding scale depending upon the proportion of the output fabricated in Canada and upon the stage to which output is processed." (Ontario, 1974a,45)."

To the extent that assets devoted to a stage of processing constitute a reasonable proxy for output at a given stage, such a sliding scale already exists in the administrative system of the Mining Profits Tax, but is not formally set out in the Mining Tax Act. The Committee's supplementary recommendation "that the processing in Canada need not be done by the same firm: it is sufficient that the resources be processed and fabricated in Canada by any firm (Ontario, 1974a,46)," is well taken. It would be relatively simple to allow this under the existing system by permitting transfer of tax credits between firms.

The Interim Report also proposes a few new policy initiatives. In putting these proposals forward, the Committee included a very important rider:

"As a general guide to the implementation of new policy initiatives in the natural resources sector that these initiatives apply to new developments and to proven reserves not currently exploited, but not to developments currently being worked (Ontario, 1974a,55)."

The stated reason for this proviso is to avoid "an element of apparent retroactivity which Canada has sought to avoid (Ontario, 1974a,55)." Nothing is said, however, about how some of the proposed policies might affect the rate of exploitation if existing operations were affected by the proposed new initiatives. In particular, anything which is likely to reduce the period of tenure or increase the uncertainty of tenure of an existing operator tends to encourage him to speed up the rate of exploitation. As we argued earlier, the existing rate of exploitation is probably a reasonable approximation of the optimal rate. Hence, any increase in the rate would not be in Ontario's best interests. In other words, beyond the inequity of a retroactive law, and short of outright immediate takeover, economic conservation in Ontario's interest is also an important consideration favouring the same provision.

A major new recommendation contained in the Interim Report is for mandated ownership requirements in the mineral sector, aiming at 75% Canadian equity requirements in fifteen years, with a staged implementation.

Given the Committee's evident objective to promote the goal of Canadian nationalism, the mandated ownership proposal is very reasonable. The staged implementation, however, needs some careful attention. If the staging requirement set out by the Committee (Ontario,1974a,63) refer to new operations at the time the operations begin, there is a serious step function problem in the

staging. After five years 25% Canadian equity would be required; after 10 years, 50% Canadian equity; and after 15 years, 75% Canadian equity. In the fourth year, for example, there would be a major rush of new Canadian ventures to begin operations before the first step. Similar surges would occur as the time for each new higher equity ratio approached.

If the ownership requirements refer to new operations from some given announcement date, say, today, then the problem of conservation emerges again. In these circumstances, foreign owners, if they had control, would have an incentive to speed up the rate of exploitation before their equity had to be given up.

The easiest way of dealing with these problems is to have a continuous increase in the required equity ratio of each new venture at the time it is commenced: a new venture begun today would require 0%, one begun next month would require 0.4167% and so on by steps of 0.4167% per month to reach 75% in 15 years. This would avoid both the step function and the suboptimal exploitation rate.

By far the most controversial proposal in the Interim Report is the one for selective equity participation by the Ontario government in the mineral sector. We have already dealt with the general issue of public ownership, and have nothing to add at this point. The polemics of the debate are best left to the political arena.

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